## TRUSS BRIDGES.

**AN ILLUSTRATED HISTORICAL DESCRIPTION OF ALL EXPIRED PATENTS ON TRUSS BRIDGES, WHICH UNDER THE LAW ARE NOW PUBLIC PROPERTY AND FREE TO BE USED BY ANY ONE.**

*By F. B. Brock, Patent Attorney, Washington, D. C.*

The object of Josiah Browne's truss bridge (devised July 7, 1857) is to unite all the timbers of each of the chords in such a manner that each set of braces shall act at one point and upon all the timbers as *united* instead of upon "them as *separated*."

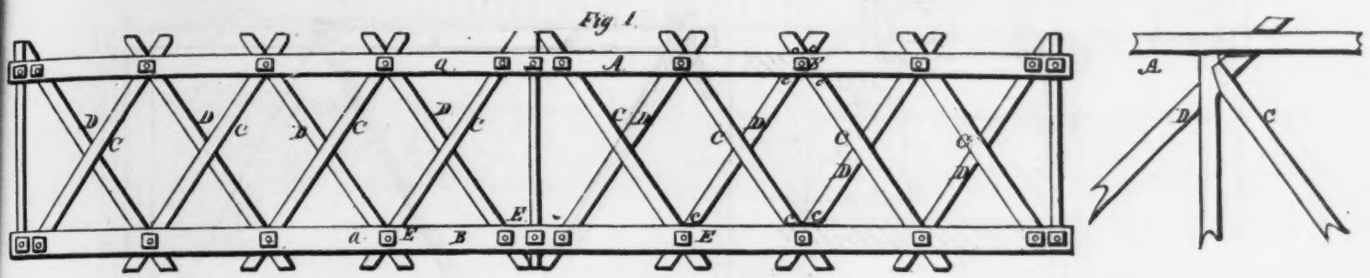
Each of the main and counter braces is provided at top and bottom with two gains, and each of the timbers of the chord with a gain at the point where the braces are applied corresponding with the gains in the the braces.

*A* represents the upper, and *B* the lower chord of the bridge; *C* are the main and *D* the counter-braces.

The outer timbers of both chords have only one gain cut in them at top and bottom, while the intermediate chord timbers have each two gains to correspond to the gains of the braces, while both main and counter braces have each two gains both at top and bottom.

The bolts *E* have no other office to serve than to hold the parts laterally together, and if removed the two chords and timbers thereof would still be united and capable of resisting all vertical strain, so the inventor says, just as effectually as if the bolts were in.

Fig 1.




BROWNE'S BRIDGE.

George S. Avery, July 26, 1857, received protection for a truss bridge.

The truss is formed in a segment of a circle or thereabout, with an arched top chord and a horizontal bottom chord connected by vertical tie rods and cross braces placed in panels or spaces decreasing in width from the center of the truss toward each end in an arithmetical ratio. This construction increases the number of tie rods and braces at or near the ends of the truss, thereby increasing the stability of the truss at the ends.

The depth of the top chord is increased from each end toward the center by inserting packing blocks or boxes of iron, increasing in thickness, between the timbers forming the chords.

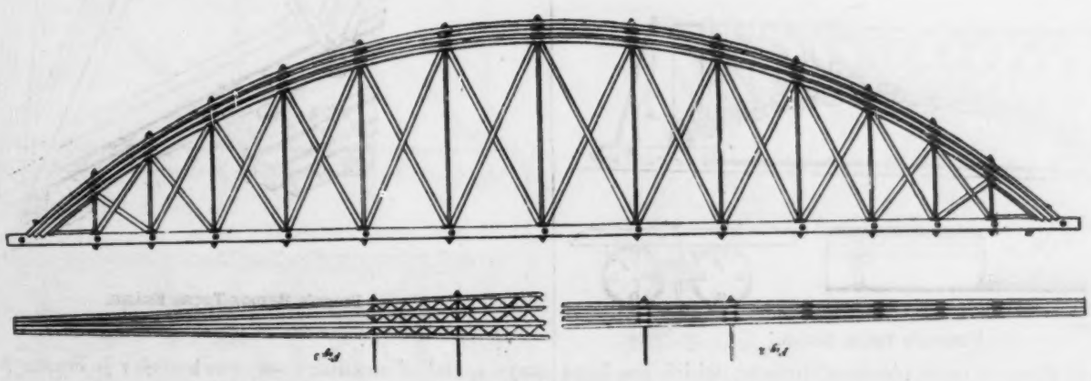
Figs. 2 and 3 show a method of increasing the breadth of the bottom chord from each end toward the center, by the insertion of wood or iron blocks increasing in thickness toward the center of the space.

The main braces are set with their feet outside of a vertical plane, or obliquely, thereby giving them a lateral position producing additional lateral strength and stability.

The principle of the bridge devised by Chas. H. Earle, Sept. 15, 1857, consists in arranging all the parts except the abutments and piers in such a manner that the bridge shall be self-adjusting and capable of yielding to the upward pressure produced by the accumulation of ice around the piers or by a freshet, by allowing the parts to be lifted to a considerable extent and of falling back again into their places as soon as the water falls.

The bridge represented in the cut consists of only a single pier, which the inventor says will serve to illustrate his construction.

*A A* are two abutments. *B* is the bridge in two parts, framed in any suitable manner of timber. The parts are united by a knuckle joint *a* or by a hinge to one of the abutments or piers. The pier *C* is constructed of a series of piles *b* driven into the bed of the river in a line parallel with the direction of the stream. They are fitted with caps *c* capable of sliding up and down upon them. The caps *c* support the contiguous end of the parts of the bridge *B* by means of short rings and eye bolts *d*; *m* represents pivoted barbs on the lower ends of the piles for the purpose of preventing any tendency of being dislodged during the rise of the floor of the bridge.

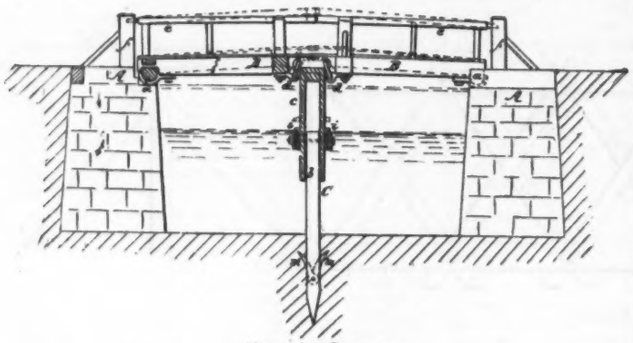


AVERY'S BRIDGE.

The most important feature in the bridge devised by Thomas Durden (June 1, 1858) is the construction of the arch of the iron tubes, with interposed blocks and arched timbers or binders. *A* are tubes of wrought-iron plates riveted together. They are arranged side by side in the form of an arch. *B* are blocks secured between the tubes at the ends and bolted thereto. *C* are arched timbers or

iron binders fitting over the tubes and blocks. The tubes *A* may be strengthened at the points where they are clamped between blocks *B* by cores or disks *f*, which may be fitted and keyed in them or cast therein. *D D* are sills at each end of the bridge, and *E* are very stout upright posts, tenoned and secured into the sills. The ends of the arch of tubes rest in an angle between the sills and posts, and the ends of the arched timbers *C* are tenoned into the posts.

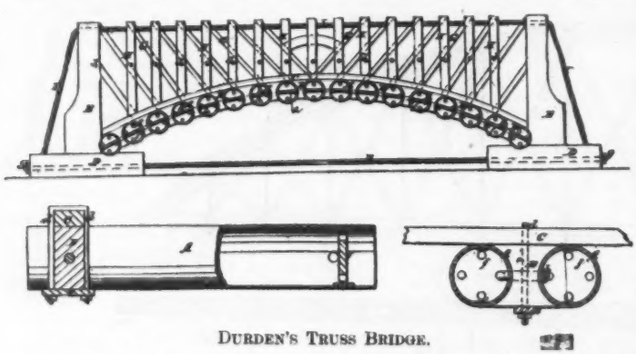
*F F* are tension rods of wrought iron connecting the sills, and extended by nuts *g* at the ends so as to confine the sills longitudinally for the purpose of counteracting any thrust on the ends of the arch. *H* are upright posts resting upon the arched timbers *C*. The diagonal braces *G* are



EARLE'S BRIDGE.

notched and bolted at their lower ends, and at their upper ends also where rest against the posts. *I* are tension rods passing through all the posts *E* and *H* and down to the sills, to which they are secured by nuts. *J* are the roadway bearers. The arch constitutes the entire support of the load, the duties of the other parts being to keep the arch in shape and to transmit to it the weight of a load passing over the bridge.

The bridge patented by Albert D. Briggs, and which expired July 27, 1872, was designed for the purpose of increasing the bearing surface for the bearing blocks against which abut the truss frames. The top and bottom chords

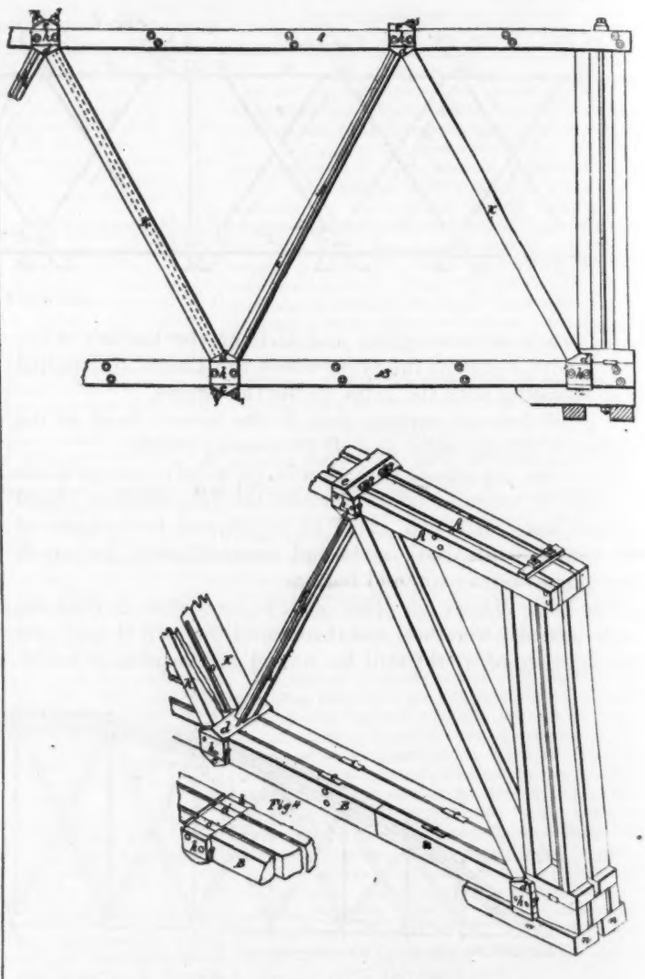


DURDEN'S TRUSS BRIDGE.

are made of three or more pieces of timbers, which are kept apart by means of keys *c*, and which pass vertically through the openings in the chords. Upon both top and bottom stringers also are placed angled bearing blocks *d*, against which the main braces *k* and the counter braces *i* abut. These braces forming the panels of the bridge are so arranged that the bearing blocks *d* of the top chord are in vertical planes, which pass through or near the centers of the spaces between the bearing blocks of the bottom chord. The tension rods *f*, by which the straining of the frame is effected and regulated are double, having the counter braces *i* arranged between them. These rods pass through the bearing blocks *d* and *e*. Between each pair of braces *k k* there is a counter tension rod *o*. The method of increasing the bearing surfaces of the blocks consists in extending the blocks beyond the sides of the chords seen at *g*. Between the corresponding bearing blocks *d e* of each chord are fitted blocks *h h* and keys *c* of hard wood to keep the bearing blocks apart, and prevent the crushing of the chord timbers by the screwing up of the nuts of the tension rods, the blocks *n* being placed between the ends of the bearing blocks, and extending beyond the sides of the chords.

Aug. 17, 1858, Stephen H. Long again appears as a patentee for truss bridges, the nature which consists in the combination of the suspended truss frame with an invented suspension arch and also in the introduction into the truss of auxiliary stays as a means of strengthening and fortifying the truss frames of the bridge.

The trusses consist of upper and lower chords of strut posts *p* and counter wedges *x*, of main stays *q* and counter



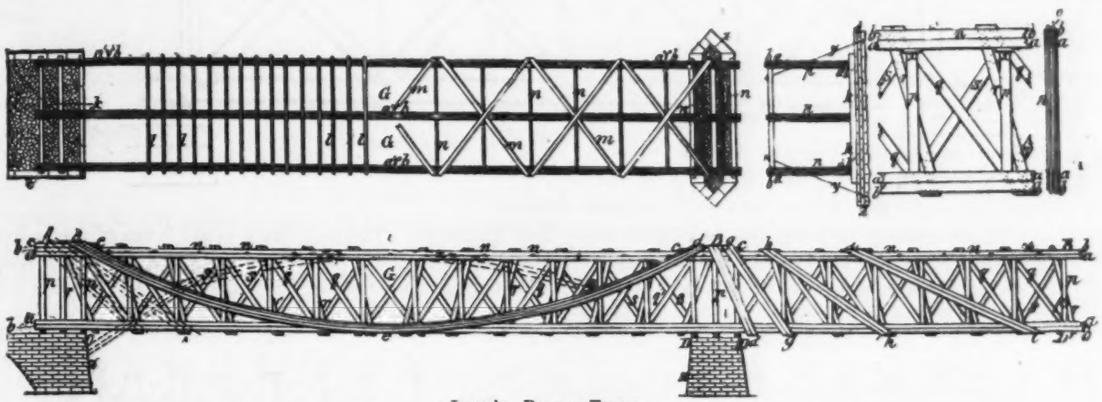
BRIGG'S BRIDGE-TRUSS FRAME.

stays *s*, and of auxiliary stays or braces *r* in connection with each strut post of the frame throughout the entire frame.

The suspension arches *d e* must be firmly attached to the upper strings of both ends of the latter and to the lower chord at the center. The auxiliary stays *r* are secured to both the upper and lower strings a little in the rear of the posts with which they are connected and a little in advance of the same post at its foot, having an inclination in the same direction as the main stays in an angle considerably less. Long sometimes employs in connection with the suspension arches, arch stays depending from the top of the abutment or pier panel and attached to the lower strings at or near the foot of the first and second or the first, second and third posts. Long also supplies thrust arches, for the purpose of counteracting in part the thrust to which the upper strings are necessarily subjected at all points intermediate to the abutments of the bridge. Arch braces ris-

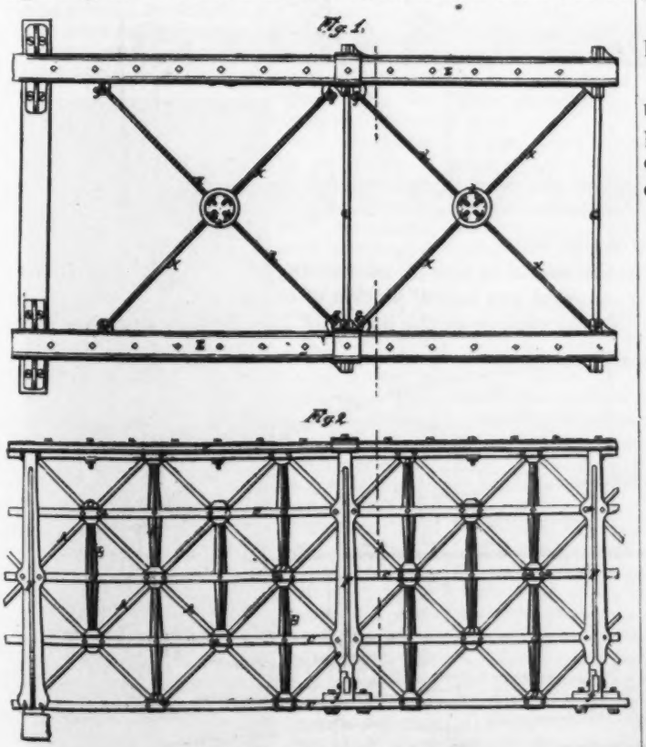
ing from a step on the abutments are also used, crossing the arch stays and the suspension arches, and abutting against the latter at or near the extremities of the thrust arches, for the purpose of communicating their action, and serving as abutments to the thrust arches.

Fig. 1 shows a plan, and Fig. 2 a side elevation of a portion of a bridge truss invented by Lucius E. Truesdell Aug. 31, 1858. Truesdell's invention consists of a double



LONG'S BRIDGE-TRUSS.

series of horizontal ribs or chords combined with a series of diagonal and vertical braces, by means of which the strain and tension of the various parts under a rolling weight is in a measure neutralized by the tendency of these parts to distribute the weight more evenly over the whole structure. *A A* are two series of diagonal braces running in opposite directions so as to intersect with each other at right angles. *C C* are a double series of horizontal ribs or




TRUESDELL'S TRUSS FRAME.

chords so arranged as to run on either side of the diagonal braces, and to which they are firmly secured at their point of intersection by means of a clamp, thereby forming, as it were, a double net work. In order to render this framing more rigid, a vertical standard *B* is interposed between each of the spaces formed, for which purpose sockets are formed in the upper and under side of the clamps for the reception of the ends of the vertical braces. At the point of intersection of the diagonals they are each bent or curved in opposite directions for a distance equal to the width of the other, so that they shall fit into and form a lock or tie.

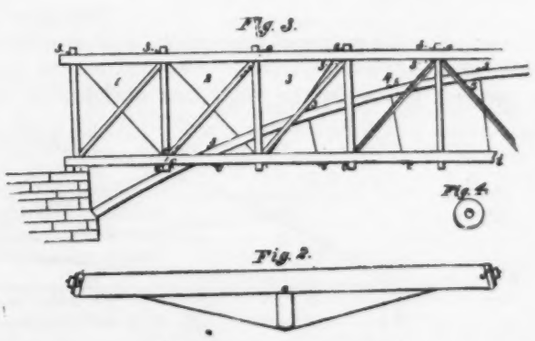
The upper ends of standards *F* are fitted under a cast-iron frame of suitable shape, which forms the top of the vertical framing of the bridge. Clamps also secure the lower ends of the standards to the lower chord.

The object sought to be attained by John C. Briggs by an invention, the patent for which expired Nov. 23, 1872, was to give elasticity to the compressed joints of truss frames. It consisted in the application of springs to either the bearings of the posts, main or counter braces, or to any compression rod of the bridge.

He proposed to make his springs of india rubber in the form or shape given in similar springs in use on cars, that is, short cylinders with holes through their centers.

Figs. 1, 2, 3 show the application of his invention, and Fig. 4 the spring.

*S S* are the points to which Briggs believes the springs may be most economically applied; and *E E* indicate points where the springs might be applied with similar effects. The application at one point in the panel is generally considered to be sufficient.




The advantages are said to be, that the truss is rendered more elastic and therefore less liable to be broken by a sudden strain, and its durability is increased by lessening the effects of the constant jar and concussions. The springs (having been gauged and tested) serve as dynamometers, by which the different strains can be more accurately ascertained and proportioned, which is desirable when two systems are combined, as the arch and truss frame shown in Fig 3. Unequal contraction and expansion of different parts of the same truss can take place without doing violence to each other or makinng loose joints.

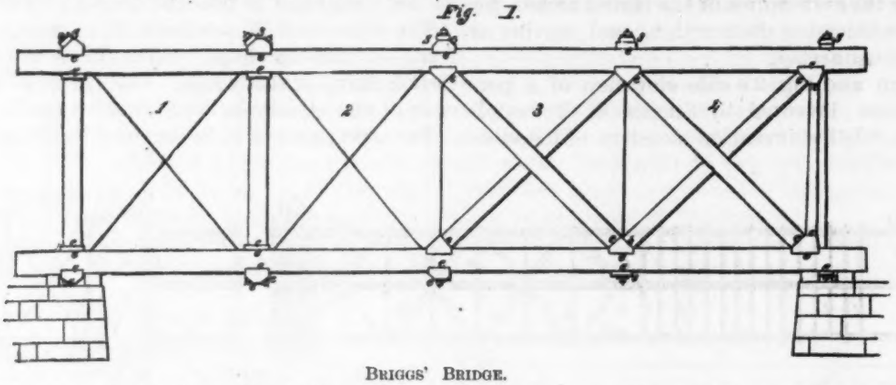
Lewis Eikenberry of Pennsylvania, denominates his invention as a "compensating iron bridge." It expired Jan. 25, 1874. The uprights and diagonals of the truss frames are

united together so that they shall be capable of turning on their points of connection, and thus whenever expansion or contraction in the metal occurs they may be able to compensate therefor without ceasing to brace the bridge at top and bottom. A combined lattice side frame is used formed of diagonal bars and angle-iron uprights which are united so as to run upon the points of connection, as above stated, with tubular or angle-iron arches. The arches are fitted within recesses formed in the angle-iron uprights, so that all the parts forming the combination shall receive the strain of the bridge.

*A* are the piers, and *B* the iron shoes fitted to the abutments *C* are the side frames of the bridge. The posts *a* of these frames are of angle-iron so as to combine strength and lightness. The auxiliary posts *b* are of angle-iron, and the diagonals flat. *D D* are arches of different radius for supporting the trusses; they are fitted in recesses *e* formed in the lateral flanges *f* of the angle-iron uprights. Links *g* prevent any lateral motion of the arches.

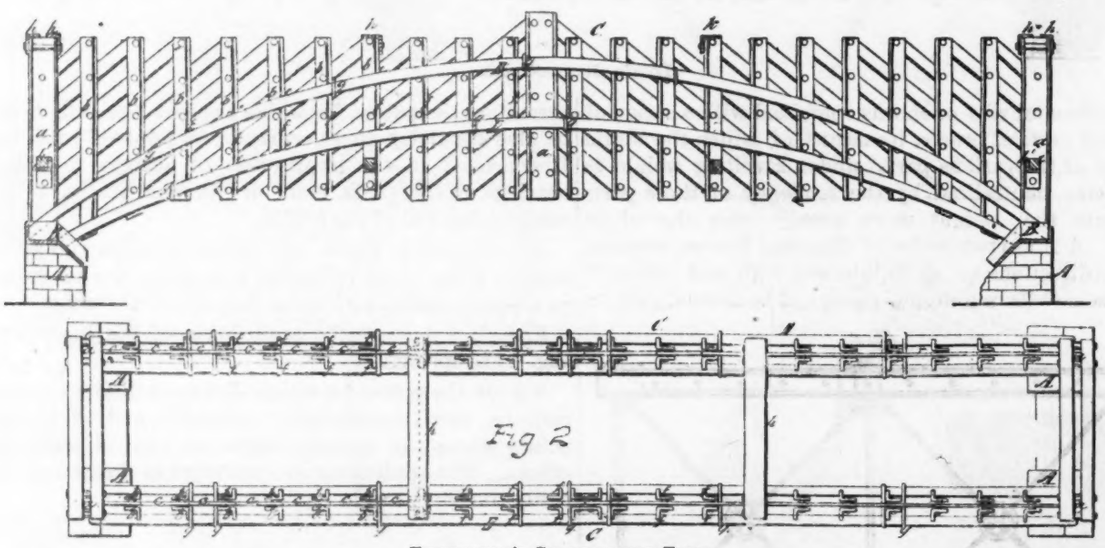
If any change in the length of the arches, uprights and diagonals occurs by reason of expansion, they cause an upward thrust, which, owing to the point of connection being

Fig. 1.

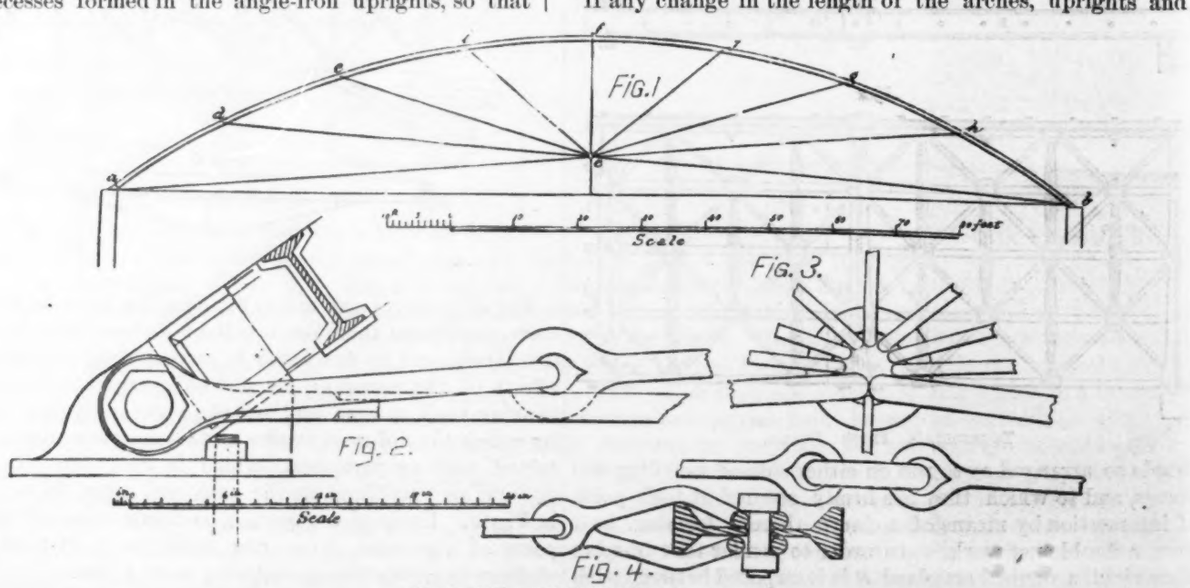


BRIGGS' BRIDGE.

Fig. 1




EIKENBERRY'S COMPENSATING TRUSS.




MEIG'S & REEVES' TRUSS BRIDGE.

loose, will be equal throughout the bridge, and an upward pull (it is stated) upon all the points of connection will take place, making them rise slightly. Owing to this rising the diagonals will be caused to move closer together and stand at a greater inclination to a perpendicular. Consequently while the arches rise intermediately between their ends, instead of slipping on the piers, the diagonals and uprights also rise with them, thereby dispensing with the necessity of having the ends of the bridge slip upon the abutments.

June 7, 1859, Samuel J. Reeves, of the Phœnixville Bridge Works, and Gen. M. C. Meigs, late Quartermaster General, but now on the retired list, and at the present writing supervising architect of the new Pension building at Washington, now in process of erection, patented a truss bridge.

The nature of the invention consists in the use of tension rods attached to various parts of a metallic arch and converging at a common point included between the arched beams.

Fig 1 represents a truss of a span of 150 feet. *a b c d e f g h i* are tension rods, which are all attached to the arch at the outer ends, and converging at the point *c*, the straight line *a b* joining the extremities of the arch.

Any irregular load applied to and tending to force inward at the center or to depress any point, as *g*, of the arch will tend to cause some other part, as *e*, to rise or recede from the center, and this tendency (it is stated) is resisted by the tension of the tie at *e*. By the tension of this tie and those adjoining the force or strain is transmitted to the point *c*, which being by the lower ties *a b* firmly joined with the fixed ends of the arched rafter where they rest upon the walls, the tie *e* (and those adjoining) cannot yield to the strain produced by the load at that point, without stretching, breaking the ties, or dislocating the arch, which is not likely.

Fig.2 is a mode of connecting the ties with the end of the beam by means of bolts, the shoes resting upon the wall.

Fig. 3 represents one mode of connecting the ends of the radiating ties where they meet at point *c*.

Fig. 4 is a mode of connecting the outer ends of the ties or tension rods with the arched beam.

Reeves and Meigs consider this kind of truss practicable for spans of upward of 200 feet.

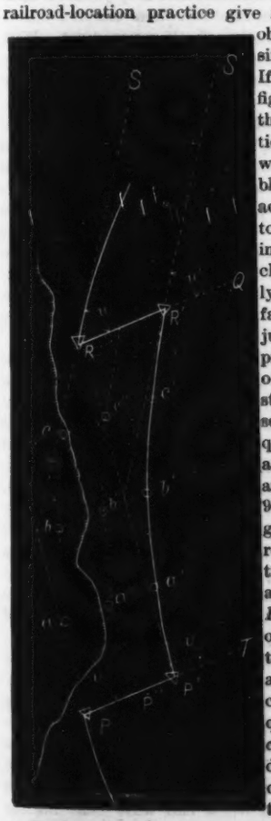
(TO BE CONTINUED.)

## CORRESPONDENCE.

### ALIGNMENT OF A CURVE OVER AN OBSTACLE.

EDITOR ENGINEERING NEWS:

The adage that "*There is nothing new under the sun*," is so nearly infallible that to say of the following method of "getting around" an obstacle which may occur in the location of an alignment curve on railroad or other work that it is original would doubtless be incorrect; I will simply say that I do not know of its mention or use by any other person. Notwithstanding, I should assume that it was in general use, and withold this mention of it, did not all of the leading authorities in railroad-location practice give methods for this object much less simple in their use.



If *a*, *b*, and *c* in the fig. are points in the required position of a curve, which are impossible of, or difficult of access, owing either to the existence of intervening obstacles, or to their lying in the rugged face of a bluff or just over a precipice, or in the edge of a marsh or stream, run an offset *P P* of any required length and at any convenient angle *V*, preferably 90°, with the tangent at *P*. At *P* restore the direction of this tangent and locate the curve *P a' b' c'* past the obstacles to *R* with the same deflection angle and chain-chord as in the required curve, *P a b c*. At *R* restore the direction of the first offset by making the angle $U = V + n\ D$ where D is the degree of the curve, and *n* the number of chains run from *P*; the negative sign in expression for *U* holds good when the offset is on the same side of tangent as the center of curvation. The positive when on the opposite side. Run *R' R* equal and parallel to *P' P*. At *R* restore the direction of the tangent *R S* by making the angle $U = U$. From this tangent *R S* continue the line as desired. For accuracy of alignment, long foresights as *PT*, *R' Q*, etc., will, of course be employed.

Not the least of the advantages of this method is the ease with which points *a*, *b* and *c* in the final curve may be located, and relocated during work likely to disturb them, as blasting or heavy cutting or filling, by either using a transit and chain from *a' b'* and *c* or—sufficiently approximately for all but track-centers—by running another curve *P' a'' b'' c''* identical with the other curves, and, with a chain and flag poles, ranging in *a* from *a'* and *a''*, *b* from *b'* and *b''*, etc. This operation is further simplified by making, if possible, *P P'* = 1 chain.

I have found in practice this feature of the method to be a frequent element of economy in time and in accuracy where the line, either wholly curve or tangent or partly each, ran repeatedly on and off the spurs of a rocky bluff.

OLIN H. LANDRETH, Prof. of Engineering,
Vanderbilt University, Nashville, Tenn.

### UNCERTAIN DESCRIPTION OF LAND.

Office of
Board of Aid to Land Ownership (Limited).
RUGBY, Tenn., April 20, 1883.

EDITOR ENGINEERING NEWS:

I desire to thank you through the columns of your valuable paper for your kindness in publishing my letter signed "D" and sketch in your issue of March 31 in reference to "uncertain description of land."

I withheld my name then as well as the name of the place, from publication, my object being to get disinterested opinions, and to put the matter in the shape of a problem. But when I wrote you first, there was quite a valuable piece of property involved in the question, in fact it was in litigation, but has since been compromised. The tract is the *town site* of Rugby, Tenn., and because I, as engineer and surveyor of the Board of Aid, could not agree with a certain highly learned? knight of the "Jacob staff," a native of this part of Tennessee (Cumberland mountain) in running a straight line from the junction of White Oak and Clear Fork streams to the "Double Maple," the beginning, a low, miserable attempt was made to swindle the colony out of that portion of land between the dotted line on plan and Clear Fork. I tried to reason with this distinguished surveyor, but in vain; he would, without being able to give an intelligent reason, insist that the line should be direct from the junction to the beginning. I can assure you, Mr. Editor, that I was quite surprised to find in a surveyor (who ought to be an enlightened man) such dense ignorance, to call it *nothing worse*. I now feel highly honored in being upheld and corroborated by such gentlemen as Messrs. Hood and Tripp, and also by your correspondent "C," and yet in spite of this, the testimony of such an illiterate man, calling himself a surveyor (bless the mark) would perhaps have more weight before a mountain jury than the testimony of an educated and trained surveyor.

The great drawback to the proper settling up of this beautiful and fertile mountain country is the litigation and trouble caused by bad and inaccurate surveys, the only instrument used by the native being the "Jacob staff," and compass and chain; this foresight generally being a "White Oak," and if upon arriving at the place any difficulties should arise in finding the "White Oak" why in that case he would take the *nearest* "White Oak," though it might be a quarter of a mile away from the right one.

The Board of Aid, in order to avoid all this trouble in the future, are getting an accurate survey made of their extensive lands, so that settlers may have no fear of any difficulties on the score of disputed boundaries, so far as the Board's lands are concerned.

I have as my assistant in charge of the field work a thoroughly competent man, a graduate and A. M. of "Cambridge," England, and in retracing old lines he finds some extraordinary work, owing to general incompetency on the part of the surveyor as well as local attraction of the needle, variation etc.

Previous to the building of the Cincinnati Southern Railroad, and the opening up of this country thereby, land was not considered worth paying skillful surveyors to survey, hence anybody possessing the necessary instruments, viz, the veritable "Jacob staff" and compass and chain might start out as a full-fledged surveyor, provided he would work for laborer's wages and survey about 1,000 *acres per day*.

The time is fast approaching, however, on account of land becoming every day more valuable, when the only use these worthies can make of the "Jacob staff" is to enable them to make rapid strides to some benighted land, such as this has been before the advent of railroads, civilization and enterprise. Yours truly, ROBERT WALTON,
Engineer and Manager Board of Aid.

OMAHA PAVEMENTS.—To prevent the pavement from being ruined by frequent taking up to repair gas and water pipes, an Omaha expert proposes to widen the sidewalks from sixteen to twenty feet, and to lay the gas and water mains under this four-foot extension of sidewalk. It is found to ruin the asphaltum pavement to break through in search of water and gas leaks.

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### NOTICES OF MEETINGS.

A meeting of the Ohio Institute of Mining Engineers will be held at Youngstown, Ohio, on Wednesday, May 9, 1883, with headquarters at the Tod House.

The meeting is public, and all are invited. A full attendance of members is expected. Representatives of the leading Mining and Civil Engineering Journals will meet with us.

The exercises will consist in the reading of papers. Discussion of the following topics:

"Signals in Mines," "Lighting of Mines," "Fees and Salaries," "Mining Machinery," "Old and New Methods of Working Coal," "Mining Engineering and Surveying," "New Legislations," "New Litigation," "Surveying Instruments," "Oils," "Lamps," "How to Keep Survey Points," "Drill Holes," "What is Inflammable Coal," "Horn-backs," etc., etc.

Report of Committee on Constitution. Reports of Officers. Inspection of Mines near Youngstown.

A. ROY, President.

R. S. PAUL, Secretary.

"*Science*" is the title of a new scientific weekly published by Moses King, at Cambridge, Mass. In size it is a small quarto of about thirty pages of reading matter; its appearance displays taste and judgment, and the illustrations scattered through it are well executed. As suggested by the title, the aim of the managers is to cover the entire field of scientific knowledge, giving all that is new and of interest to the student, and much that is of value to the general reader. "A weekly summary of the progress of science" is one of the features of the publication to be especially commended; in this department, under the proper headings from Astronomy to Zoology, a careful summary seems to be made of the weekly progress of the scientific world; each extract giving the title of the journal in which it appeared, and bearing a number by which it can be referred to.

[Terms, $5 per annum in the U. S. and Canada; $6 in International Postal Union.]

PERSPECTIVE DRAWING.—While an intimate knowledge of perspective drawing is not an absolutely necessary accomplishment in a civil engineer, a general acquaintance with the methods would be useful to him on many occasions. He, too frequently in fact, has to submit his plans to the criticism and perhaps judgment of the non-professional, and while the true merit of the design depends in no way upon the manner in which it is submitted to paper, the engineer can often better explain his intention to critics of the above class by a perspective than by a right-line drawing.

In this connection we notice a just-published "Treatise on Modern Perspective," by Prof. Wm. R. Ware of the School of Mines, Columbia College. This work being originally intended for the student, is clear in expression, sub-divides the matter under appropriate heads, and embodies the latest practice together with the accepted principles of plane and cylindrical perspective. The text is accompanied by twenty-seven folio descriptive plates in a separate portfolio. J. R. Osgood & Co., of Boston, are the publishers, which is in itself a sufficient warrant for the typographical excellence of the book. [Price, complete, $5.].

## THE LYNN (MASS.) WATER-WORKS.

We make the following extracts from the annual report for 1882. The total receipts, deducting moneys received for new pipe laid, was $93,280.33, an increase of $12,891.03 over 1881. The expenditure for maintenance was $12,577.04, a reduction in expenses of $1,021.76 as compared with 1881. After paying all expenses, including $54,065.62 interest charges, the excess of earnings over interest and maintenance was $27,776.86.

The quantity of water drawn from the distributing reservoir was 551,428,907 gallons in the year 1882, an increase of 84,342,873 gallons over 1881, equal to a per capita increase of 2-10 gallons.

The superintendent states that the consumption for the last four years has exceeded the available supply from the ponds by 66½ million gallons, and in the last year 75 million gallons. The deficiency has been supplied by tubular wells and drawing upon the stored water. An immediate increase in the supply is necessary, and early attention is called to this matter.

## "SOLID SENSE" IN SEWERAGE.

In the last number of our esteemed contemporary, the *Engineering and Mining Journal*, we notice an article on "Sewage and Sewerage," which betrays some lack of practical knowledge on the subject. It is a review of a report submitted over a year ago by Jas. T. Gardiner to the New York State Board of Health. The main points in the report are indorsed with the remark that it contained, together with Col. Waring's article to the *Century Magazine* on "The Sanitary Condition of New York," written two years ago, more "solid sense" on the subject of sewerage than many bulky volumes. Our readers will remember that our own comments on these papers, at the time they appeared, were rather in a different strain. Mr. Gardiner asserts that sewers receiving storm water and sewage are "a failure," and praises the separate system requiring two distinct conduits for the purpose, a remarkable statement in the face of existence of the many good combined systems in use, especially in Europe. His theory regarding the spread of bacteria is also but a speculation, and as far as it discriminates against the combined system is without the slightest proof. As a matter of fact, it has in no instance been demonstrated that the greater cost and inconvenience of two sets of sewers is justified by a sanitary gain. The preference between the two systems must be decided on grounds of expediency only. The absurd recommendation of Col. Waring to lead the New York street water away in iron gutters with perforated covers did not reveal much "solid sense." In advocating his patented Memphis system the claims of science and experience are left to go a begging.

## ENGINEERING VS. POLITICS.

Wm. B. Knight, the present City Engineer of Kansas City, Mo., has been, it seems, a stumbling-block in the path of the contracting fraternity in that city; and his reappointment is made an issue upon which now hangs a "dead-lock" in the Kansas City Councils. From a number of interviews published in the *Evening Star*, of the city named, it appears that his competence, integrity and general fitness for the office are not in question, even his enemies grant that no fault can be found with him for lack of professional ability; but while not flatly given as a reason for his removal, one of his grave shortcomings is evidently the fact of his publishing *too much* in his reports. Mr. Knight it seems has not adhered to old-time methods in that section, but in his annual report told just what was done with all the money expended on his department, and went even further still by telling what was done with the city's cash by his predecessors. In doing so he has brought down upon himself the wrath of a certain contracting clique, and all their personal and political influence is now brought to bear against his reappointment to office.

We mention this little occurrence not because it is new, but because it sets forth an only too common ruling factor in the selection of city officers. The fact that an honest and efficient official can and will save money for the tax-payer has little weight with the average Warwick of a number of our goodly towns and cities; especially so when we consider that money thus saved would otherwise line the purse of the said Warwick, and support and fatten his political following. It is not to be wondered at that a dishonest clique should demand, in the head of a department, a minimum of honesty and brains; but it is remarkable that the well-meaning portion of a community (and they are always in a majority) should be so blind to their interests as to permit this filling of office by unworthy applicants. Self-interest alone should teach them that the best available man, he who is most fitted by education, previous experience and general good character, is the one to whom they should intrust the improving of a city, for example, and the expenditure of public funds. In their private business they soon make a change in the management, if things do not work properly; why, then this apathy when the public purse and weal are at stake?

## MEXICO.

Senator John T. Morgan, in the May number of the *North American Review*, draws a parallel between the sister republics of Mexico and the United States. His text is evidently suggested by the more intimate trade relations which the extension of the railway systems of both countries are rapidly bringing about. Tracing the struggles and progress of our neighbor from the first dream of political independence to its successful realization, Mr. Morgan shows how much they were encouraged by our own experience, and what honors Mexico really gained in achieving her liberty from Spanish, French and Austrian bondage; the more remarkable when we reflect that, unlike our colonies, two hundred and fifty years of absolute and most despotic rule had crushed out in Mexico every thought of self-government. With them it was a lost art; with us the spirit of liberty had been recognized from the very beginning of English sway.

The powerful influence of the "Roman Catholic Apostolic Church," which by the constitution of 1824 was the "perpetual religion of the Mexican nation," is cited as a cause of much of Mexico's later trouble in gaining her independence and founding a free democratic government. Like our own guarantee of slavery, it has cost Mexico much blood and treasure to reform its constitution and remove from it this restricting religious clause that must have otherwise been fatal to the government."

The author concludes that there is enough in the sisterhood of the two republics, so much alike in history, and geographically the nearest of neighbors, to bind them together for all time. While both countries possess extraordinary wealth of commercial resource, they are in actual competition in only a few of their natural productions. Moreover, the two countries united have virtually the military and commercial command of the Gulf of Mexico with its 700,000 square miles of deep and quiet waters, a sea that will add more to the civilization and wealth of the Western Hemisphere than did the Mediterranean to the advancement of the human family in Europe, Asia and Africa.

Prejudice, resentment and jealousy should not exist in the minds of the citizens of either country, but sincere friendship only; both are entering upon a new epoch, and neither should fail to appreciate the mutual advantages presented. "The peace and tranquility of our sister republic, and her increasing strength and influence, will be the strongest proof the world can have that Mexico and the United States have demonstrated the power of free democratic and republican government to give security to liberty and happiness to mankind."

## ENGINEERING RECREATIONS AND REMARKS.

HOWE TRUSS ANGLE.—Mathematical conundrums naturally receive a good deal more attention than they deserve, particularly from young engineers. One of the most famous is the Howe truss angle block problem, namely, given *b* the breadth of the brace, *a* the clear length of the panel and *d* the clear depth of the panel, required to find the exact length of the brace and the two sides of the angle block. Hundreds of young men have wasted thousands of hours in trying to solve it, while the older men have looked on and smiled. The newspapers have learned to systematically reject all solutions of it, knowing that an endless and unsatisfactory discussion will result. The last solution we saw in print was ingeniously effected by the use of the differential calculus, and was, like most solutions, wrong. An exact mathematical solution of the question is, however, possible, but to write down the formula would be impracticable, for it is longer than one's arm.

USE OF MATHEMATICS.—Mathematics, beyond the mere elements, is in fact of very little use to the engineer. The calculus may be said to be of no use at all, the first care of the young graduate being to forget it. It is difficult to see why, in view of all this, so much of the time of the technical student must be spent on this difficult branch of study. Prof. Vose, who has written a very able paper on the training of students in civil engineering, says that descriptive geometry is of no practical use, but that it is taught to discipline the mind. Our own impression is that descriptive geometry and calculus are taught because it is the custom, and it would not be well for us without very good reasons to depart from that custom. Technical education, in fact, is a new thing, an experiment, and how it will turn out in the end cannot now be foretold. Perhaps, after all, we may come to conclude, with the editor of the *Railroad Gazette*, that the education of a school not technical is the best and most satisfactory.

GRAPHICAL STATICS.—The graphical methods of investigation and illustration that have been so developed during the last ten years have done much to drive out the methods of integration by the calculus. To find the deflection of a beam no calculus, either differential or integral, is required, for it may be shown to depend on the area of a certain parabolic curve, which may be determined by simple geometry. This method, although but lately brought forward with any prominence, is really over thirty years old, having been published by Gen. Hermann Haupt in 1851 in his book on bridge construction. This book and that of Whipple in 1847 are, we believe, the oldest American works relating to strains in bridges, and very excellent ones they were. Both Haupt and Whipple were practical bridge builders, and hence they blended theory charmingly with practice. Nowadays practical bridge engineers seem too busy making money to write books.

CENSUS STATISTICS.—The census of 1880 reports 2,587 persons as "bridge builders and contractors," against 1,029 in 1870. The business has more than doubled, according to these figures, and many other industries have shown a like growth. In 1810 there were reported as "builders and contractors" 7,511 persons, while in 1880 there are 10,804. For 1880 there were 13,391 persons in these two classes, of whom 11 were females and the rest males; 11 were between the ages of 10 and 15; 12,470 between 15 and 60, and 910 over 60 years of age. All these and many other facts do the census reports set forth with much detail. The number of architects, civil engineers, designers, draftsmen and inventors is carefully given, but the surveyor is not mentioned, probably because the word includes not only land measuring but many other kinds of work.

NUMBER AND LOCATION OF CIVIL ENGINEERS.—The number of civil engineers is given as 8,261, of whom 2 are between the ages of 10 and 15; 7,708 between 15 and 60, and 551 over 60. Their nativity is as follows: 7,097 from the United States, 170 from Ireland, 296 from Germany, 357 from Great Britain, 53 from Scandinavia, and 288 from other countries. There were 73 located in Alabama, 29 in Arizona, 80 in Arkansas, 390 in California, 273 in Colorado, 120 in Connecticut, 85 in Dakota, 19 in Delaware, 56 in District of Columbia, 58 in Florida, 37 in Georgia, 13 in Idaho, 299 in Illinois, 153 in Indiana, 198 in Iowa, 159 in Kansas, 162 in Kentucky, 112 in Louisiana, 79 in Maine, 110 in Maryland, 412 in Massachusetts, 273 in Michigan, 149 in Minnesota, 46 in Mississippi, 352 in Missouri, 41 in Montana, 115 in Nebraska, 44 in Nevada, 56 in New Hampshire, 288 in New Jersey, 51 in New Mexico, 1,082 in New York, 73 in North Carolina, 432 in Ohio, 89 in Oregon, 990 in Pennsylvania, 104 in Rhode Island, 58 in South Carolina, 125 in Tennessee, 329 in Texas, 56 in Utah, 39 in Vermont, 173 in Virginia, 44 in Washington, 88 in West Virginia, 215 in Wisconsin, and 32 in Wyoming. For every civil engineer there are eight clergymen, eight lawyers and ten doctors. For a long time the supply of clergymen, lawyers and doctors has been in excess of the demand, and it now seems as if the number of those who are called civil engineers is nearly as high as the needs of the country require.

THE SUN SPOTS AND CIVIL ENGINEERS.—Business is now good and the civil engineer rejoiceth. But when the panic comes he will be the first to mourn. And the panic is fairly sure to come before many years have rolled away, for on the 19th of June, 1881, occurred the most remarkable conjunction of planets known in modern times, Neptune, Uranus, Saturn, Jupiter and Venus being all together in the eastern sky. The collected mass of these planets attracted the photosphere and chromosphere of the sun and caused violent disturbances, resulting in those deep holes or black spots that have lately defaced the solar orb. These disturbances have caused electric storms and the electric storms have influenced the atmospheric conditions and produced great floods and peculiar weather. The next step will be for said weather to affect the crops, and thereby to cause panics and financial disasters. Thus it is, said Col. Higgins, that periods of commercial depression are caused by bad weather, and the bad weather by disturbances in the electric equilibrium, and said disturbance by the sun spots, and the sun spots by gravitative perturbations due to the conjunction of planets. Yes, said the Colonel, as he slowly nodded his gray head, thus does modern science show that the ancient astrology contained within a mass of superstition some fundamental germs of truth.

## ENGINEERING IN OTHER LANDS.

*(Translated for Engineering News.)*

FRENCH PUBLIC WORKS.—The political uneasiness in Europe has undoubtedly interfered with the "bringing on" of new projects, and the more rapid completion of the preliminary work of others—but some of the great undertakings that were mooted a little time ago have by no means been allowed to drop. There is no question, indeed, but that the state of French finances will not allow of the great Freycinet system of public works being pushed forward as was intended, and the lack of orders that will be the consequence will be felt among iron manufacturers, etc., to a serious extent. The deepening and regulation of the harbors may also be somewhat deferred. However, strategic reasons are all powerful, and much will be primarily done in the interest of Mars which will eventually redound to the benefit of Commerce. Thus the *Bulletin de la Reunion des Officiers* has an article on a proposed tunnel between Paris and Rouen. It would be 117 kilometers in length, and the total expense would be estimated at 130 million francs. "The tunnel would be of great strategic importance, as it would be impossible to intercept passage in it except by arduous mining. In time of war it would render impossible any blockade of Paris, and would form in time of peace a direct commercial route between Paris and Rouen." It is certain, however, that private enterprise will replace the action of the government, and that the latter will offer every inducement for constructing public works.

MOUNTAIN WATER SUPPLY IN EUROPE.—The supply of water becomes a peculiarly difficult engineering problem in mountainous regions. The whole region from La Rochelle, in France, to the western frontier of Bohemia is composed on its upper part of calcareous rocks to a great extent, and then covered with vegetable earth. In a hydrographical point of view, the rocks are covered only at the base and half-way of the chain of mountains with this vegetable soil that is only just sufficient to retain the fluvial waters. There are about 72 rainy days and 52 days of snow.

It will be easily seen how the upper parts, with the crevices of the subjacent rocks and the slight amount of earth, become arid in fact—and this explains the fertility of the valleys. The inhabitants of a large and arid elevated plateau in Suabia were placed in the necessity of obviating such disadvantages. The government of Wurtemburg engaged competent engineers, while the communes themselves subscribed cheerfully to the expense of the surveys. The whole district is now supplied with water, and as it is perhaps the first application of the system on a large scale, a few details of the work will be interesting. The localities were divided into nine groups according to their geographical situation, each of the groups being served by hydraulic machines which drove back the water into one or more upper reservoirs. Various systems of turbines were used, and these or wheels were actuated by water collected in the gorges before it came down in the valleys. Steam engines were used in exceptional cases. The water supply was calculated at the rate of some seventy gallons *per capita* per diem—not very large, but amply sufficient for the needs of a rural population, but the pumps were made to supply fifty per cent. more. The water was derived from springs, from sunk wells, and even from drainage and fluvia water previously filtered. Group 1 contains fifteen hamlets, varying from 2,399 to 15 inhabitants, but as the needs of the cattle have also to be taken into consideration, mere population is no index. The wants of villages aggregating 50,000 inhabitants were satisfied at a total cost of some $800,000. The experiment shows that isolated mountain districts need not suffer from want of water, provided there is any in the valley.

REGULATION OF EUROPEAN RIVERS.—The regulation of several European rivers—the Rhine, Rhone, Seine, etc., will form important studies for engineers. The construction of dams on the lower Seine, which lasted from 1846 to 1870, has made the port of Rouen what it is to-day—a rival to Havre in some respects; and it even inoculated the Parisians with the idea of having their city a port. Perhaps a few figures will show better what science can do in utilizing and improving Nature's works. The depth of the Seine was but 9 ft. 2 in. in 1846, and only vessels of 200 tons could enter it. The minimum depth at present is 18 ft., and 33 vessels drawing from 19 ft. to 21 ft. 3 in. reached Rouen last year, the total tonnage of that port being now 1,500,000 tons, or three times the amount what it was before the engineering improvements. The dams are now in a very dilapidated condition and their repair and enlargement has been decided on along a length of some 30 miles. In some places the cost is estimated at $50 per running yard.

PARALLEL JETTIES.—The ports of Calais and Dunkirk are instances of the injury caused by parallel jetties in forming sand banks. The jetty of the latter port has been protected by a kind of movable wooden stockade, which was moved further out when the sluices were opened, and thus an endeavor was made to prevent the formation of the bar. Dredging is increasing year by year and is now some 250,000 cubic metres. The port engineer attributes the filling up of the channel to the system of sluices. The mud and silt is carried off at low tide toward the west, and if the sea is calm, is deposited; in rough weather the sand is merely held in suspension and is brought back by the tide.

## PERSONAL.

SAYRS G. KNIGHT has been re-elected City Surveyor of Racine, Wis.

HENRY LEMBECK has been elected President of the Jersey City Board of Works.

A. A. ROBINSON has been re-appointed Chief Engineer of the Atchison, Topeka & Santa Fe R. R.

MR. C. C. SCHNEIDER, of No. 35 Wall street, New York, has been appointed Chief Engineer of the new bridge across the Niagara River.

GEO. E. GRAY is Chief Engineer of the Southern Pacific Railroad. He superintended the construction of the San Fernando Tunnel of the Central Pacific Railroad.

Capt. EDWARD MAGUIRE of the U. S. Engineers, stationed at St. Paul, Minn., has leave of absence for six months to go abroad. Capt. MAGUIRE left St. Paul several days ago.

MILTON COURTWRIGHT of Erie, Penn., a distinguished civil engineer and railroad contractor, died at Norfolk, Va., March 25. At the time of his death he was engaged in constructing the Virginia Beach Railroad.

NEW YORK, April 26, 1883.—After May 1, please address all communications, etc., to me, at 86 and 88 Liberty street, or P. O. Box 2227, instead of 239 Broadway. HENRY R. WORTHINGTON, 239 Broadway, N. Y.

HUGH MCGRANSALLE, of Mount Forest; ELEZER LABERGE, Montmagny; C. E. S. BOATH, Kingston; L. M. DESCHESNE, St. Roch; H. H. STEPHENS, Owen Sound; W. A. DECKER, Port Elgin; HUGH O'DONNELL, Quebec; T. J. PATTON, Toronto, and A. B. ST. JEAN, of Port Joli. The following successfully passed the preliminary examinations: WALTER MACDOUGALL, G. B. KLOCK, E. C. CHURCH, Aylmer; E. DUPUIS, Ottawa; S. R. VOLGUY, Montreal; A. HAWKINS, Listowel; T. D. GREENE, of Ottawa.

At the last examination of the Board of Dominion Land Surveyors the following candidates obtained certificates and were admitted to practice:

PITTSBURGH, Pa., April 21.—SYLVESTER A. COSGROVE late financial manager of the Siemens-Anderson Steel Company, who has been on trial for several days on the charge of obtaining $15,000 from MILES & SON of Chicago on false representations, was to-day found guilty in the Criminal Court and recommended to mercy. He is now undergoing trial on a second charge of the same nature. COSGROVE is a man of high standing in business circles, is a well-known politician and was the Democratic nominee for City Treasurer several years ago. His conviction creates much excitement.

MR. JAMES PARK, JR., proprietor of the Black Diamond Steel Works, Pittsburgh, Pa., died last Saturday morning of paralysis. His was the largest merchant steel manufactory in the world, not excepting even Sheffield, Eng. He was also a member of the firm of Park, Scott & Co., and was manager of McIntosh, Hemphill & Co., limited; President of the Pennsylvania Cotton Mill; Vice President of the American Iron and Steel Association, besides being largely interested in various banks, railroads and bridge companies. He spent all last winter in the interests of the tariff at Washington. Mr. Park was worth $3,000,000.

ALEXANDER H. MITCHELL, of Milwaukee, is said to be worth $15,000,000, and he has in Scotland, whence he came, a schoolmate who is worth $40,000,000. It is related that the two met in France a few years ago and spent the day together. The Glasgow man paid all the bills. At the close of the day, when the two sat down to dinner, the Glasgow banker pulled out a card, and turning to MITCHELL, he said: "Sandy, you owe me $1.65." This was Sandy's share of the expense of the day. Mr. MITCHELL was in this city, last week, on his way from Florida. The old gentleman looks as hearty as ever, and could be seen daily taking his whiskey toddies at Delmonico's Broad Street house and at his club as unconcerned as if he had never heard of either gout or paralysis. He does not neglect business either, for he gives bull points to all his friends, and has managed to market some $1,700,000 of 7 per cent. collateral trust bonds, redeemable at 105.

JOSEPH J. DEKINDER, Civil and Hydraulic Engineer, has been appointed by Col. LUDLOW Chief Engineer of the Philadelphia Water Department, to the office of General Superintendent of Works of the Department. Mr. DEKINDER is a native of Holland, and in that semi-amphibious country spent the earlier years of his professional life in, probably, the best school for hydraulic engineers in the world. He was also engaged as Marine Engineer in the Dutch navy for several years. He came to this country five years ago, entering the service of Peter Wright & Sons, agents for the American Steamship Co., and principal owners of the Red Star line of steamships. Two years ago he commenced the private practice of his profession, in which he has been eminently successful, especially in planning and constructing all classes of marine work, dredging machinery, scows, tug boats, etc. He is also engineer for the Baltimore firm of Samuel R. Waite & Co., shipbuilders, etc. Mr. DEKINDER is one of the most active and energetic working members of the very flourishing Engineers' Club of Philadelphia.

JOHN B. MCMASTER, author of the new "History of the People of the United States," was born at Brooklyn, Long Island, June 29, 1852. His grandfather was ROBERT BACH, a prominent Brooklyn merchant in the days when that city numbered 16,000 souls. His father was a JAMES MCMASTER, native of New York State, and, till the war opened, a banker and planter at New Orleans. Mr. MCMASTER's early years were spent in New York. Here he was educated in the public schools, and graduated from the College of the City of New York in 1872. For a year he taught English grammar in that institution as a fellow, but in 1873 he set out to become a civil engineer, spent some time in Virginia and Chicago, and when the panic came on returned to New York to go on with the history, for which materials had been collecting since 1870. Some reviews have attributed to him the works of the late JOHN RICHARD GREEN as a model. But the plan of the first volume of the "History of the People of the United States" as it now exists was drawn in 1871, and much of the material arranged when, in 1874, Mr. GREEN'S first volume appeared. As the book now stands, it has been twice written entirely from end to end, and some of the chapters from three to eight times, as the acquisition of new material seemed to require. In 1877, Mr. MCMASTER was appointed instructor in civil engineering at Princeton College.

## OBITUARY.

Col. Andrew Talcott, the engineer under whose plans and direction the Richmond & Danville Railroad was built, and father of Col. T. M. R. Talcott, died at his residence, No. 519 East Leigh street, Richmond, Va., Sunday evening, the 15th. The deceased was born in Glastonbury, Conn., April 20, 1797. He was a cadet at the United States Military Academy, at West Point, from March 14, 1815, to July 24, 1818, when he was graduated, standing No. 2 in his class. He was promoted in the army to brevet second lieutenant in the corps of engineers July 24, 1818. He served as assistant engineer in the construction of the fort at Rouse's Point, at the outlet of Lake Champlain, N. Y., in 1818–19. August 14, 1818, he was made second lieutenant in the corps of engineers. From Nov. 1, 1820, to April 30, 1821, he served as aide-de-camp on the staff of Brevet Brigadier-General Atkinson, and as an engineer on the expedition to establish forts on the Upper Missouri and Yellowstone rivers.

He was made first lieutenant in the corps of engineers in October, 1820, and was assistant engineer in the construction of the defenses of Hampton Roads from 1821 to 1824. He was engineer in charge of preliminary operations for fortifying Brenton's Point (site of Fort Adams), R. I., and New Utrecht Point (site of Fort Hamilton), N. Y., in 1824-25; of construction of Fort Delaware, Del., 1825-26; of Dismal Swamp Canal, 1826-28; of Fort Monroe, 1828-34; (brevet captain, Oct. 1, 1830, for faithful services, ten years in one grade), and Fort Calhoun—or "Rip-Raps"—Hampton Roads, from 1828 to 1835. He was astronomer for the determination of the boundary line between the States of Ohio and Michigan, from Dec. 1, 1832, to May 30, 1836, and having been made captain in the corps of engineers, served as superintending engineer of the Hudson River, N. Y., 1834-6.

On the 21st day of September, 1836, deceased resigned from the army. He was thereafter engaged consecutively as adjunct chief engineer of the New York & Erie Railroad, and in charge of the Western division; superintendent of the improvement of the Delta of the Mississippi River; member of the commission for the exploration and survey of the northeast boundary of the United States, and of the commission of naval officers and engineers for examining Portsmouth and Pensacola navy yards.

In 1848 he came to Richmond, and from January 11 of that year to July 31, 1855, he was chief engineer of the construction of the Richmond & Danville Railroad. After finishing this road, he was employed in various enterprises in other States till December, 1857, when he went to Mexico to construct the Mexico & Pacific Railway from Vera Cruz, through the City of Mexico, to the Pacific Ocean. He was appointed Chief Engineer of the State of Virginia in March, 1861, and was charged with the superintendence of the river, coast, and harbor defenses of the State, until the Confederate States Government assumed the work, December, 1861, when he returned to Mexico and resumed the charge of the Mexico & Pacific Railway. In 1867 he returned to this country, and took up his residence in Baltimore, and there remained until October, 1882, when he removed to Richmond.

The deceased was a man of conspicuous talent in his profession. He was the inventor of the Talcott method of determining latitude by means of the zenith instrument, which is now generally used not only in the United States Coast Survey, but throughout the world.

Colonel Talcott was the oldest living graduate of West Point Military Academy, and was three years ago invited to preside over the alumni meeting. He was prevented from doing so, as his son, Colonel T. M. R. Talcott, could not accompany him, as had been arranged.

Miss Ann Cary Talcott, daughter of deceased, was married in Mexico October 3, 1865, to Colonel Von Boleslouski, who was there as aide-de-camp to the Emperor Maximilian, of Mexico, and ranked as lieutenant-colonel and chief of cabinet. He retired as captain of Austrian Lancers, and resides in Vienna.—*Richmond Dispatch.*

## THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page* 184.)

### DXXV.—PETOSKEY, MICH.

Petoskey, Michigan, in lat. 45° 20′ N., long. 85° W., on Little Traverse Bay, on Lake Michigan, is a favorite summer resort. The date of its settlement is not given. Water-works were built by the village in 1880, after plans of W. R. Coates, taking the supply from a large well near Bear River, a small stream at the west end of the village, and pumping it by Knowles pumps, driven by water power, directly into the mains, for ordinary use. For fire service an iron tank is placed on high ground at the east end of the village, 210 ft. above the pumps, and is kept constantly filled. Distribution is by 3 miles of cast-iron pipes, of from 10 to 4-in. diameter, with 20 fire hydrants and 10 gates. The number of taps is not given. The population varies from 1,815 in winter to 15,000 in summer. The daily consumption is not given.

The works cost $20,000. No further financial statistics are obtained, except that the revenue from water rates is sufficient to meet all expenses of maintenance and interest, and leave a surplus for a sinking fund.

### DXXVI.—FRANKLIN, PA.

Franklin, Pennsylvania, in lat. 41° 23′ N., long. 80° 10′ W., is on the Allegheny River, at the mouth of French Creek. It was incorporated a city in 1868. Water-works were built in 1878 by a private company, taking the supply from springs collected into small reservoirs 162 ft. above the city.

The population in 1880 was 5,010.

The capital stock is $49,850. The bonded debt is $22,000, at 5 per cent. interest.

J. L. Hanna is President and W. W. Dale, Secretary.

### DXXVII.—HOLLY, MICH.

Holly, Michigan, is in lat. 42° 50′ N., long. 83° 35′ W. No information as to topography and the date of settlement of the town is obtainable. Water-works were built by the village in 1879, taking the supply from the Shiawassee River, through an 8-in. pipe 359 ft. long, and pumped directly into the mains by two steam Walker pumps with 14 in. steam and 7½ in. water cylinders of 12 in. stroke. The water passes through a Perkins compression reservoir 4 by 12 feet of boiler-iron.

Distribution is by 3 miles of Wyckoff wooden pipe, of from 8 to 4 in. diameter, with 20 fire hy-

drants. The number of taps is not given, nor the kind of service pipe.

The population in 1880 was 1,443.

The daily consumption is not stated. The works cost $10,098. No further financial statements are given.

D. W. C. Wade is Chairman of the Water Committee.

DXXVIII.—REED CITY, MICH.

Reed City, Michigan, in lat. 44° N., long. 85° 20 W., is on rolling ground on the Hersey River.

Settled in 1872, it was incorporated in 1875. Water-works were built by the city in 1882, taking the supply from a well 12 ft. in diameter and 14 ft. deep, 10 ft. of which is through satuated gravel. Connection is also had with the river. Water is pumped directly into the mains by a No. 10 steam pump constructed by Dean Brothers. The ordinary pressure is 20 pounds and the fire pressure 110 pounds. Distribution is by one mile of Wyckoff wooden pipe of from 8 to 4 in. diameter, with 10 fire hydrants, 6 gates and 25 taps. Service pipes are of wrought iron.

The population in 1880 was 1,091. The consumption is not given.

The works cost $9,000, which is the amount of the bonded debt at 6 per cent interest. The works went into operation in July 1882. The expenses for 1882 were $1,500 and the receipts $500. The works are managed by a Board of Water Commissioners. Willis M. Slosson is chairman.

(TO BE CONTINUED.)

The receipt of statistics as follows is acknowledged with thanks:

From Willis M. Slosson, Chairman of Water Commissioners, statistics of Reed City, Mich., water-works.

From W. R. Coates, statistics of Petoskey, Mich., water-works.

CORRECTIONS.—The statistics of the Johnstown, Pa., water-works, acknowledged on April 14, were received from James M. Swank, Jr., not *Frank*, as printed.

*Atlantic City*, April 21, 1883, p. 184.—The main from pump to stand pipe is of 12 in. diameter, and not 16 in. The stand pipe is in the city, not 6 miles from it. The source of supply is on the mainland, and the pumping main crosses "The Thoroughfare" by siphon with flexible joints. In cold weather it is necessary to keep the water in motion on the pipe crossing the salt water and marsh, to prevent freezing.

## WHEN THE IRON HORSE WAS A COLT!

The Secretary of the National Exposition of Railway Appliances is in receipt of a letter from Mr. David Matthew, the builder and engineer of the first steam-drawn train on the Mohawk and Hudson Railroad, the first trip of which was made August 9, 1831. Mr. Matthew was in charge of the construction of the first three locomotives built in this country, not for experiment, but for definite business purposes.

The first two of these were built for the South Carolina Railroad Company, and their subsequent history is somewhat obscure. The third was the well known "DeWitt Clinton," which made the trip from Albany to Schenectady on that memorable 9th of August. The late Thurlow Weed was one of the passengers on this train, there being fourteen in all, filling two coaches. These were ordinary stage-coach bodies, which permitted through the doors and windows a clear view of the passengers within, who, in the old drawing of the train, are seen sitting in pairs on each of the three inside seats, in solemn, stove-pipe-hatted dignity.

With Mr. Matthew's letter is a large card containing, besides explanatory printed matter, two photographs. One is of Mr. Matthew himself, showing a white-bearded bright-eyed, young-faced old man. The other, somewhat faded, represents the first train with its attendants and passengers.

This iron horse, in our fathers' eyes a marvelous creature, beneficent, but terrible, was indeed a colt. Small, loose-jointed, scrawny and weak, compared with the shining, splendid colossus of the present day, whose swiftness shakes the earth and whose neighings fill the hills with thunder; but it was a genuine and renowned sire of a mighty line of descendants.

It will be interesting, indeed, to look upon the man whose hand gripped the reins of this historic steed in its first wonderful and victorious race! Mr. Matthew writes:

'You can say I raised the first shelter over engine-men in the world, and they are indebted to me for protection from sun, rain, wind, snow, and from the showers of sparks, dust and smoke which come from the smoke-stack."

It is expected that Mr. Matthew will be in attendance at the Exposition, and thousands of railway men and others will be glad to see and talk with him.

## LIVERPOOL ENGINEERING SOCIETY.

The seventh meeting of the session was held on Wednesday, the 11th of April, at the Royal Institution, Colquitt street. Mr. H. Bramall, President, in the chair, when a paper entitled "The Pitchometer," was read by Mr. W. Chambers. The author, in opening the subject, dealt with the defects and inaccuracies that are frequently met with in propellers, and which have the effect of impairing the efficiency of steamships and their machinery, and then described how these defects may occur, and illustrated the method of molding propellers in the foundry and exhibited a model showing how the existing foundry plans may be supplemented and simple means adopted by which the accuracy of the molds could be easily and expeditiously ascertained and any errors corrected before casting.

The application of the pitchometer for measuring the angle of the blade by which the pitch of a propeller is ascertained was next described, and various applications for adjusting moveable blades, giving a propeller the advantage of a variable pitch were fully dealt with; and he then described and exhibited an admirable pitchometer designed by Mr. Hutton and kindly lent for the occasion by Messrs. D. McGregory & Co., of South Castle street.

12th April, 1883. R. L. T.

# NEWS OF THE WEEK.

BALTIMORE & OHIO R. R. SURPLUS. $44,000,000, and growing at the rate of $700,000 in six months.

PRICES OF PAVING IN MINNEAPOLIS.—Cedar blocks, $1.48½ per yard, against $1.99 last year; granite, $2.65, against $2.75 last year.

TUNNEL WORK.—The tunnel west of Blairsville, which is intended to lower the track of the West Pennsylvania Railroad, has been under construction for the past year. It is in the shape of a sharp curve, and the headings, which were run from both ends, met in the center of the curve within half an inch. Some remarkable work has been done on this tunnel, and all previous records have been eclipsed. During the past four months 150 feet of tunnel have been completed each month, and in March this was exceeded, 200 feet being constructed, something all the more remarkable when it is considered that the section of the tunnel is the largest in the country.

ARTESIAN WELL SCHEME.—A scheme is on foot at Billings, M. T., to organize a stock company with a capital of $10,000, for the purpose of boring artesian wells in that vicinity.

NEW WATER-WORKS.—Ashburnham, Mass., is to have a general water supply system.

GRADING CONTRACT.—A contract will shortly be let by the Northern Pacific Terminal Company to fill in Couch Lake, near Portland, Or., as a site for a union depot. The filling will be done with sand from the Willamette River and the contract price will be between $300,000 and $400,000.

SHARON WATER-WORKS.—The bill to incorporate has passed the Massachusetts Legislature.

WELLESLEY (MASS.) WATER-WORKS.—The Senate bill to authorize Natick to supply above town is recommitted.

TROY & GREENFIELD R. R. & HOOSAC TUNNEL.—$265,000 is appropriated for double tracking and improving.

NEW LONDON BRIDGE.—The bridge over the Thames at New London, Conn., is to cost $1,000,000. The main pier at the abutment on the New London side of the river will have to be sunk 120 feet, in order to find a solid foundation. A. P. Boller, C. E., was engaged all last summer in the hydrographical surveys for this bridge.

ARTESIAN WELL FAILURE.—The Atlantic and Pacific Railroad has abandoned the attempt to strike artesian water at Ash Fork, N. M. They sunk to a depth of 800 feet at a cost of $20,000.

CORSICANA (TEX.) WATER-WORKS.—A meeting of prominent business men was held on the 18th at the bank of Garrity & Huey to revive the water-works question. A committee was appointed to take charge of the matter, consisting of R. Q. Mills, Bryan T. Barry, Jos. Garrity, E. Whiteselle, C. W. Jester, and C. H. Kerr. The absolute and imperative necessity of water-works has presented itself, and the emergency will certainly be met this time, as the matter is in proper hands.

THE ERIE AND WYOMING.—Smith & Ripley, of New York, who are the principal contractors for the construction of this railroad across the Hoosic Mountains from Hawley to Pittston, made a tour of the route on the 18th, accompanied by Chief Engineer Chanute, of the Erie road, and Engineer Sebastian Wimmer, with an army of sub-contractors, for the purpose of familiarizing themselves with the obstacles to be encountered in this costly undertaking. The road will be 47 miles long, and will traverse a country full of abrupt hills and deep chasms. Work will be commenced in a week and completed within a year. It will be carried on in 45 sections, and employ 2,000 men.

MINNESOTA IRON CO.—This company will at once commence constructing 80 miles of railroad, which it is intended to put under contract by May 6, and to complete by August 1, 1884. The route of the new road will be from Duluth down the shore of the lake to Agate Bay, thence due north to Vermillion Lake. A town will be laid out at the lake, and another at the Bays, to be called the Two Harbors. The latter place will be the point of shipment for ore to be sent down the lakes. The managing man is George C. Stone, late President of the Duluth & Iron Range R. R. Headquarters are at Duluth.

OVERPAID.—One of the Canadian Pacific Ry contractors has been overpaid $70,000.

NEW JERSEY WATER-WORKS.—Twenty-one cities and towns in New Jersey have been provided with water-works, at a total cost of $12,600,000. The share of Jersey City is $4,918,493, of Newark $3,300,000, and of Paterson $1,415,007.

RAILROAD TO ATLANTIC HIGHLANDS.—A new railroad four miles long is to be built form Hopping Station, on the Port Monmouth branch of the New Jersey Southern Railroad, to Atlantic Highlands. The company was organized on Wednesday, with Senator John S. Applegate as President, and with a capital stock of $100,000. It is to be completed by July 1. Passengers to Atlantic Highlands will change cars at Red bank, instead of going on to Long Branch, as now. The New York and Long Branch Company will operate the new road.

NEW BRIDGE.—Clarke, Reeves & Co., of Phenixville, Pa., are building a iron deck bridge across the James River at Richmond, Va., for the Richmond & Petersburg Railroad. The contractors for the masonry, Messrs. Netherwood & Co., have already begun the stonework upon the piers and abutments.

N. P. R. R.—The final survey of the Northern Pacific's new road from St. Paul to Sauk Rapids is now being made. Work upon the road is to be pushed forward and, it is expected, will be finished before next winter.

CANADA PACIFIC R. R.—Complete arrangements have been made for the construction during the present season of the Canad an Pacific line from the end of the track to Calgarry. Langdon, Shepard & Co. are the contractors.

NEW RAILROAD.—Work has been commenced by the surveyors of the Little Falls & Dakota road on the line between Morris and Ortonville, Minn. The first ten miles has already been let.

A NEW PROJECT.—INDIANAPOLIS, Ind., April 20.—A company will in a few days file articles of incorporation with the Secretary of State, which proposes to build a railroad from Maxwell, on the Indiana, Bloomington & Western road, middle division, to Fairland, on the Cincinnati, Indianapolis, St. Louis & Chicago road, passing through Greenfield, Ind. Maxwell is twenty-two miles east of Indianapolis, and Fairland twenty-one miles east of this city. The distance across, via Greenfield, is twenty miles. The names of the directors have not yet been made public.

PACIFIC COAST CONTRACTS.—Contracts to the amount of $16,000 for the improvement of the streets of Seattle were let. The Chinese firm which took the big contract last fall to repair the streets of Seattle want no more such work. They lost $5,000 by the job, and it broke them.

THE WIDOW'S MITE.—"But here," said Salmi Morse to the reporter of the *Sun*, "is something interesting indeed," and unlocking a drawer, he took from a box a small, old, worn and defaced copper coin, of which we are told in Mark xii., 42, that "two make a farthing." In its present condition, certainly, it will take more than two of them to make an English farthing, equivalent to half a cent of our money. "This little bit of copper is worth a house," he said. "It was the 'mite' of which the widow's two outweighed in the scales of heaven all that had been cast in by all the rest, 'for all they did cast in of their abundance; but she of her want did cast in all that she had, even all her living.' This was coined by Herod, as I think I can make out the name Harodi on it.

"Is this coin unique?" I asked.

"I believe it is. I have never heard of another specimen, and I have made many inquiries. It is very curious, and it cost me a pretty curious sum. The British Museum would pay high for this. And here is another which it tried hard to get from me, but, though I would not sell, I intend to bequeath it to them."

It was a small silver coin of Cyrus the Great which he said was certainly unique, and which he saw dug up from the excavations of Babylon. There was no head on it, but both sides are crowded with letters, which he said were "Cyrus, the King of the World," and "Babylon, the City of the World."

FERGUS FALLS (MINN.) GAS AND WATER-WORKS.—Carroll E. Gray, of Athens, Mo., a widely-known contractor for gas and water-works, has secured the

franchise for building the above works. Mr. Gray has constructed the following water-works: Pueblo, Col., Hannibal, Mo., Stillwater, Minn., St. Charles, Mo., Palestine, Tex., Gunnison, Col., Hot Springs, Ark., also built the following gas-works: Alliance, O., Lawrence, Kan., Sherman, Tex., Kankakee, Ill., Joplin, Mo., Washington, Ind., Carthage, Mo., Denison, Tex., Gunnison, Col.

A NEW SOUTHERN ROAD.—A syndicate of Boston capitalists have subscribed $999,500 to the capital stock of the Mt. Pleasant, Santee & Little River railroad which is to run from Mt. Pleasant in Charleston harbor to Little River, N. C. From the latter point the syndicate has secured a charter for a line to Richmond. The work of construction will commence at the southern terminus within the next sixty days.

OLEY VALLEY R. R.—Engineers are surveying a route for the new Oley Valley Railroad, from Birdsboro to Stonersville, Berks County Pa. Ultimately the road will be extended into Lehigh County.

A NEW BRANCH FOR READING.—POTTSVILLE, April 23.—The Philadelphia & Reading Railroad Company has organized an engineer corps, with Mr. C. W. Buchholz at its head, who are to run the line for a new railroad link between this place and Shamokin.

THE SAN FERNANDO TUNNEL.—Colonel George E. Gray, Chief Engineer of the Southern Pacific road, having been sworn, was examined by Mr. Foote, but all questions relative to the cost of any part of the road met with no success, he saying that the construction proceeded only under his inspection and supervision and that he had nothing to do with the cost. He said, in answer to a question adroitly put by Mr. Foote, that the reason he did not make estimates was because he knew who was to get the contract any way. He knew, incidentally, however, the cost of the San Fernando tunnel, which was, independent of the track, $1,600,000, which, he said, was a greater cost than tunnels usually averaged, but this was partially explained by the fact that great haste was used in building it, so as to connect with the Texas Pacific in time to catch the crop. It was finished in fifteen months. The character of the rock, the amount of timber and the number of pumps used had been a factor in the enormous expense, which was greater than that of any tunnel he was acquainted with. Comparison was made by Mr. Foote between this tunnel and the St. Gothard, the Mont Cenis, the Northe and the Hoosac tunnels. The Northe tunnel, in France, was principally used as a comparison. This tunnel, of a length of 15,153 feet, and made for a double track, cost but $1,298,450, while the San Fernando tunnel, less than 7,000 feet long and containing but a single track, cost $1,600,000.—*San Francisco Chronicle.*

BROOKLYN STREETS.—Mayor Low's Flatbush Avenue Extension bill has been "laid on the table." The Brooklyn Aldermen unanimously urge the passage of a bill, as approved by Mayor Low and City Works Commissioner Ropes, appropriating $300,000 for the repair of the streets of Brooklyn.

POWOW HILL WATER CO.—The Senate bill to incorporate the above company, to furnish the inhabitants of Amesbury and Salisbury, Mass., with water, was, under a suspension of the rules, discharged from the orders of the day, and passed to be engrossed.

MATERIAL FOR NEW COINS.—Joseph Wharton, of Philadelphia, was awarded the contract for supplying the United States Mint with 20,000 pounds of commercially pure nickel for minor coinage. Mr. Wharton is the largest nickel manufacturer in this country.

SAULT STE. MARIE BRIDGE.—OTTAWA, April 23.—A Dominion department report favoring a railway bridge over the Sault Ste. Marie River has been signed, and the work of construction will be commenced forthwith. The proposed bridge will prove an important factor in directing the traffic of the Canadian Pacific Railway, including Michigan, Minnesota and Wisconsin, through Ontario and Quebec to the Canadian seaboard. The bridge will be 3,900 feet long, and according to Engineer Bailey's estimate, will cost about $850,000. The Canadian charter was passed last session, and the charter was also passed through the Michigan Legislature. The Sault Ste. Marie Railway has been located 150 miles east of the Spanish River. Work on the bridge will be commenced forthwith, as soon as navigation is open.

CANADA PACIFIC R. R. WAGES.—The general manager of the Canadian Pacific Railway has issued a circular giving a new schedule of wages for white labor in British Columbia. Wages will be paid as follows: Overseers, $125 per month; rock foremen, $3.50 to $4 per day; earth foremen, $2.50 to $3.50 per day; bridge foremen, $3.50 to $4.50 per day; bridge carpenters, first-class, $3.50, second class, $3 per day; masons, $2.50 to $3.50 per day; stone cutters, $3 to $3.50 per day; block cutters, first-class, $3.50, second class, $3; helpers, $1.50 to $2 per day; drillers, $2 to $2.25 per day; laborers, $1.75 to $2 per day; hewers, first-class, $2 to $2.50 per day; scorers, $2.50 per day. All carpenters must furnish their tool chests. Employés must find themselves bed, board and lodging. The company has good boarding-houses along the line, where board can be procured at $4 per week, but employés will not be compelled to board in the company's houses. Wages will be paid on the 10th of each month.

MASSACHUSETTS WATER-WORKS.—Senate bill to incorporate the Quincy Water Company: Water Supply—By Mr. Allen of Plymouth, reference to the next General Court of the petitions of the cities of Boston and Cambridge and the town of Andover to take the water of the Shawsheen River for a water supply. The committee recommend Stony Brook Basin in Waltham, Weston and Lincoln as a water supply for Cambridge. A minority of the committee recommend that the water now wasted in Boston should, as far as practicable, be utilized before additional sources of water should be secured.

HOPKINTON (MASS.) WATER-WORKS.—At an adjourned town meeting, held Monday last, J. A. Woodbury was chosen Moderator. The most important business was to appropriate money for putting in water-works through the center of the town, both for fire and domestic purposes. After a protracted debate, $17,200 was granted by a vote of 91 to 63, authorizing the Hopkington Water Board to issue 4 per cent. bonds under the Hopkinton Water act, said act accepted by the town August, 1877, by a vote of 27 to 5; $1,225 was appropriated to purchase land bonded to the town, upon which three wells are sunk, from which they are to receive the proposed supply.

GAINESVILLE (TEX.) WATER-WORKS are being talked of again.

JAIL CONTRACT.—Joseph G. Miller, of Washington, Md., has the contract for building the jail and sheriff's residence for that county. Price, $25,500.

IRON CEMENTS.—The *Technische Commerz Zeitung* gives the following receipts for cements for iron:

Cement which Resists Heat and Water—Lime, 10 parts; iron fillings, 5; vinegar, 2; water, 3.

Black Iron Cement for Iron Ovens—Iron filings, 10 parts; sand, 12; bone-black, 10; slaked lime, 12; lime milk, 5.

Cement for Objects which have to be Heated—Iron filings, 100 parts; clay, 50; common salt, 10; quartz sand, 20.

Cement for Fastening Iron to Stone—Fine iron filings, 10 parts; plaster of paris, 30; sal-ammoniac, ½. These are mixed to a fluid pasts with weak vinegar, and used at once.

Cement for Iron Cisterns—Finest iron filings are mixed with vinegar into a paste, which is left to stand until it becomes brown; the mass is then pressed into the joints.

Fireproof Cement for Iron Pipes—Wrought-iron filings, 45 parts; clay, 20; china-clay, 15; common salt solution, 8. If china-clay cannot be found, fire-clay will serve the purpose instead,

Ammonia Iron Cement—Iron filings, 100 parts; sal-ammoniac, 2; water, 10. This cement begins to rust after some days, and becomes very strong, and is proof against water and steam.

Cement for Annealing Boxes—Iron filings, 100 parts; lime milk, 40; quartz sand, 50; vinegar, 20. These are worked with water into a paste, to which may be added, to render the mass more porus, hair, sawdust, etc.

Iron Cement for Hermetically Closing Stove Doors—Finest iron filings, 100 parts; sal-ammoniac, 10; limestone, 10; soluble glass solution, 10. These are mixed with water to a thick paste, which is applied at once, and is left to dry slowly before heating.

Cement for Broken Iron Vessels—Iron filings, 10 parts; clay, 60. These are worked with linseed oil into a thick paste, which is applied after some more linseed oil has been added to it, and left to dry slowly.

Rust Cement for Iron—Wrought-iron filings, 65 parts; sal-ammoniac, 2½; sulphur (flowers) 1½; sulphuric acid, 1. The solid ingredients are mixed dry, sulphuric acid diluted with sufficient water being then added. This cement dries after two or three days, and unites with iron, making a very resisting and solid mass.

Cement for Filling Faults in Castings—Iron filings, free from rust, 10 parts; sulphur, ½; sal-ammoniac, 0.8. These are mixed with water to a thick paste, which is rammed into the "faults." This becomes strong when the iron filings are rusted, The parts which have to be cemented are treated before the operation with liquid ammonia, so as to be perfectly free from grease.

Fireproof Cement—(1) Iron filings, 140 parts, hydraulic lime, 25; quartz sand, 25; sal-ammoniac, 3. These are formed into a paste with vinegar, and then applied. This cement is left to dry slowly before heating. (2) Iron filings, 180 parts; lime, 45; common salt, 8. These are worked into a paste with strong vinegar. The cement must be perfectly dry before being heated. By hearing it becomes stone hard.

LEGISLATION TO PROMOTE THE CONSTRUCTION OF VANDERBILT'S PENNSYLVANIA ROAD.—HARRISBURG, April 26.—Two bills were passed to-day by the Pennsylvania Senate intended to promote the construction of the Vanderbilt railroad from Pittsburgh to a connection with the Philadelphia & Reading at this point. One removes the limit as to the amount of capital stock and bonds fixed by the General Railroad Act of 1868, and the other repeals outright the section of the Act providing that the original amount of stock and increased capital shall not exceed $60,000 per mile. Under the restrictive feature of the Act of 1868, the proposed Vanderbilt road could not be constructed, as the average cost per mile would be legally in excess of $60,000. There was very little opposition to either of these bills, and as none came from the Senators who generally represent the Pennsylvania Railroad Company, it is thought that that corporation has no objection to their passage. As it has in contemplation the construction of new lines, the company would find it convenient to take advantage of the proposed laws.

THE EYE WITH AGE.—The sight of a near object involves in the case of a normal eye an actual muscular effort. A near object is seen by rays that are more or less divergent, and which require to be more powerfully refracted than the parallel rays in order to bring them to a focus within the same space. We have seen how this refraction is brought about—by an alteration in the shape of the lens. In youth this alteration is easy enough. Elastic membranes yield readily, muscles are vigorous, and, above all, the lens itself is soft and highly elastic. But, as years go on, a gradual hardening process takes place in this crystalline body. It gradually loses its elasticity and becomes more and more rigid, and the power of accommodation constantly diminishes. It is found on an average of observations, that at 10 years of age the crystalline lens may be rendered so convex as to give a clear image of an object three inches from the eye. At 21 it will only accommodate itself to an object four and a half inches from the eye. Anything nearer will be obscure, because the lens will not assume a form sufficiently convex to retract to a focus on the retina rays of light so divergent as any nearer object will radiate. At 40 years of age, the "near point" has reached to a distance of 9 in., and at 50, to 13 in. At 60 years of age the lens has so far lost its flexibility, and therefore its power of responding to the muscle, that it cannot ordinarily give a clear image of any object less than 26 in. from the eye. At 75 the power of accommodation is wholly lost; light still passes through the eye, and is focused on the retina, but only when it comes in parallel rays. Parallel rays it can converge on the retina, but divergent rays require that extra refractive power which the aged eye has lost by the hardening of the lens. Not as a matter of disease, then, but in the ordinary course of years, and in every eye alike, is the bodily sight gradually weaned from the scrutiny of near objects around, and permitted to turn a clear vision only upon things far off.—*Chambers' Journal.*

NORFOLK & WESTERN R. R.—Net earnings for March show an increase over those of same month last year of $36,823.47, and for the first three months of this year an increase of $69,631.26 over the same time last year.

WATERPROOF COATING FOR STONE, WOOD, METALS, ETC.—A mixture is prepared by melting together 90 parts of paraffine, 30 parts of palmatite of aluminum, and 15 parts of wax. The substances to be coated should be heated to a temperature of 60° to 90° C. This forms the subject of a German patent. Palmatite of aluminum is prepared by precipitating a solution of palm oil soap with alum.

SLAWSON'S FARE BOX:—The Supreme Court of the U. S. has decided that this box is not patentable. It is not an "invention."

NEW MOUNTAIN R. R.—A railroad is being built to ascend Green Mountain at Mount Desert. It will be 6,000 feet long. The Manchester Locomotive Works are building the engine. The middle cog rail is being made by the Atlantic Works at East Boston, and is to be finished June 1. About 1,200 feet have already been shipped.

BOSTON WATER SUPPLY.—The Committee on Water Supply and Drainage will report reference to the next General Court on the petitions of the city of Boston, the city of Cambridge, and the town of Andover, severally, that the waters of the Shawsheen River may be taken and used for domestic purposes.

COLT'S ARMORY.—There has been an increase of 40 per cent. in the general business at Colt's armory, Hartford, since Jan. 1, about 1,000 men being employed.

CHAPMAN VALVE CO.'S NEW FOUNDRY.—W. C. McClallan, of Chicopee, has contracted to build the Chapman Valve Company's new iron foundry before July 1.

LONDON (ENG.) RAILWAY STATIONS.—The city of London has 14 terminal railway stations, from

which 2,302 trains depart daily, and nearly 1,600 of these leave between 10 A. M. and 10 P. M. The largest number of departures from a single terminus is 329, after which come two stations with 312 and 295 respectively. These figures are exclusive of the immense system supplying the city with local transit.

CANADA PACIFIC R. R.—It is understood an arrangement has been arrived at between the government, the contractors and the Canadian Pacific Railway Company whereby it has been agreed that the company shall finish and from May 1 operate that portion of the Canadian Pacific Railway, 435 miles, between Prince Arthur's Landing and Winnipeg.

COST OF R. R. CONSTRUCTION.—A contractor versed in railroad building says: A common prairie track costs $12,000 per mile to construct. $3,150 for grading, $3,022.50 for 56-lb. steel rails, leaving less than $5,000 for bridging, ties, tracklaying, etc. This does not include right of way. But a road equipped with depots, round-houses, etc., should not cost over $20,000 per mile, and on most roads between the Mississippi and the Rocky Mountains the cost per mile was less.

THE TOPALABAMPO RAILROAD COMPANY, of which ex-Senator Windom is president, has dispatched a representative to Paris to confer with Erlanger, the chief of the French syndicate which controls the lines of the road from Brunswick, Ga., to the Rio Grande, to try and get him to extend his line from the Rio Grande across Mexico to Topalabampo harbor, a distance of 700 miles. The company is also in consultation with the Chinese Six Companies with a view of interesting this gigantic Mongolian importing monopoly in the scheme. The Erlanger road will connect at Brunswick with a European line of steamers and with the new Gould north and south trunk line, the East Tennessee & Virginia.

THE JEWISH SHEKEL.—In weight of silver it was about the equivalent of our half dollar, though what may then have been the value of silver no man can say. It was the only silver coin possessed by the Jews, so that Judas' "thirty pieces of silver" weighed fifteen of our trade dollars. It was not coined till the time of Simon Maccabeus. Prior to that the Jews had no coinage of their own. They were a producing, not a commercial people, and the money of other peoples circulated in Judea. David and Solomon, with all their greatness and wealth, had no coinage of their own. The word shekel is not Hebrew, and the shekel itself was older than the commencement of the Hebrew people in the person of the patriarch prophet from whom they trace their descent, for did not Father Abraham, when he wanted a burial place for Sarah, buy from Ephron the field and cave of Macpelah for "four hundred shekels, current money of the merchant?" There was no head or figure on the coin, but on the obverse side a chalice, symbolical of the temple; on the reverse a triple lily. The inscriptions on the two sides of the coin were in ancient Arabic—on the one side, "Jerusalem the Holy;" on the other, "Jerusalem shall bloom like a lily." Over the chalice is "Second of Freedom," and around is written, "Shekel of Israel."

ENGINEERS' FROLIC.—MILWAUKEE, Wis., April 20.—D. J. Whittemore, of this city, chief engineer of the Chicago, Milwaukee & St. Paul road, in whose hands was placed the matter of arranging the annual convention of the American Association of Civil Engineers, has completed his arrangements. The convention will be held in St. Paul and Minneapolis, beginning Wednesday, June 20. The association numbers 700 of the most prominent civil engineers in this country and Canada, and fully half this number, with their families, will be in attendance. The Chicago, Milwaukee & St. Paul Company will furnish a special train to convey the association from Chicago to St. Paul, making the run by daylight, leaving Chicago Tuesday morning, June 19. The citizens of Minneapolis and St. Paul will tender the association a banquet, and the Northern Pacific and St. Paul, Minneapolis & Manitoba have tendered the freedom of their lines during the four days of the convention. The headquarters of the members will be at Hotel Lafayette, Lake Minnetonka, between which place and St. Paul and Minneapolis a special train will convey them back and forth. The local committee, who have the affair in charge, are: Gen. J. W. Bishop, D. C. Shepherd and Col. William Crooks, of St. Paul, and C. Hatch, Col. W. S. King and C. H. Prior, of Minneapolis.—*St. Paul Pioneer-Press.*

A MODEL ROAD.—Robert E. O'Brien, formerly constructing engineer with the Pennsylvania Railroad and subsequently Vice-President of the New York, Pennsylvania & Ohio road, and Secretary of the pool of the trunk lines and Western roads, who was selected by the West Shore syndicate to examine and report upon the New York, West Shore & Buffalo road, in his report says: "The enterprise realizes the ideal road desired by railway managers. It has everything considered essential to the perfect road; nothing can be added. It has low grades, light curves, perfect track and engines and cars of the most approved patterns, the parts of which are interchangeable. Everything is new, there being no old rolling stock or material to be used up. Under these conditions (which heretofore have never existed on any road) the operating expenses will be remarkably low—lower than any road has ever attained." The largest stockholders of the concern are foreigners, to whom the fact that the road has neither a bonded nor a floating debt has always been particularly attractive. The majority of the stock is held in London. The next largest holders are supposed to be ex-Gov. Tilden, Gen. Winslow, President of the road; Gen. H. Porter, and the firm of Alex. Taylor's Sons. Some of the German houses have occasionally come forward as large buyers and sellers of the stock, but most of them were doing a mere arbitrage or scalping business between London and New York. The road is capitalized at $60,000,000, of which $2,000,000 is represented by the preferred stock, and $58,000,600 by the common. There is no mortgage of any kind upon the road, and 6 per cent. has been steadily paid upon the preferred stock. If a stock like that of the Denver & Rio Grande road, which runs through a wilderness, and has never earned its running expenses (not to speak of its fixed charges) sells at $50 a share, there is no reason why the stock of a road running through one of the most prosperous sections of this State should sell as low as $29, especially when fully that amount has been paid in cash into the treasury by the original reconstructors, and no watering has taken place. In any case men like Messrs. Tilden, Porter and Winslow are not likely to put their money into anything that is not worth it; neither are canny Scotchmen like the Taylors naturally disposed to sweat under a heavy load, unless they see clearly a prospective benefit from it.

The coming completion of the Buffalo & West Shore road is sure to play havoc with both the New York Central and the Erie. In any case the firm of Winslow, Lanier & Co. seem to be sufficiently sure of the success of the enterprise to take up $10,000,000 more of the bonds of that company, for which they had an option. Due notice of the fact will be issued by the firm in a day or two.

A NEW BRIDGE SWEPT AWAY.—COLUMBIA, S. C., April 24.—A special from Lancaster, S. C., to the *Daily Register* says: The new bridge of the Cheraw & Chester Railroad over the Catawba River, except a small portion on the Chester side, was swept away by the freshet this morning. The bridge had been in use about ten days.

IRON CEMENTS.—The *Technische Commerz Zeitung* gives the following: *Cement for Fastening Iron to Stone.*—Fine iron filings, 10 parts; plaster of Paris, 30; sal ammoniac, ½. These are mixed to a fluid paste with weak vinegar, and used at once. *Cement for Iron Cisterns.*—Finest iron filings are mixed with vinegar into a paste, which is left to stand until it becomes brown; the mass is then pressed into the joints. *Fire-Proof Cement for Iron Pipes.*—Wrought-iron filings, 45 parts; clay, 20; china clay, 15; common salt solutions, 8. If china clay cannot be found, fire-clay will serve the purpose instead. *Ammonia Iron Cement.*—Iron filings, 100 parts; sal ammoniac, 2; water, 10. This cement begins to rust after some days and becomes very strong, and is proof against water and steam.

PARIS AND LONDON GAS.—In a lecture, M. H. Aerts, manager of the Brussels Municipal Gas-Works, says: The Paris burner consumes 105 litres, or nearly 4 cubic feet per hour. The London burner consumes 142 litres, or nearly 5 cubic feet per hour. The illuminating power required in London is 16 candles for 142 litres (5 cubic feet) of gas. The normal illuminating power of Paris gas consumed in London burners corresponds to 15.2 candles.—*Review of Gas and Water Engineering.*

NEW R. R.—LAKEWOOD, N. J., April 19.—A company of New York capitalists interested in this winter resort have organized a company for the purpose of building a railroad from this place to connect with the New York and Freehold Railroad at Freehold. This will shorten the distance between New York and Lakewood 15 miles, and decrease the time between here and Philadelphia one hour. S. J. Tilden, Cyrus W. Field, ex-Mayor Grace, and other New Yorkers are interested.

EAU CLAIRE (WIS.) BRIDGE.—At a late meeting of the council a resolution was introduced for the Mayor to appoint a committee of five to solicit proposals for the building of a bridge on the site of the one recently washed out on the Eau Claire. The structure is to consist of two spans, to be a three-truss construction, with two roadways of not less than eighteen feet each in width, and two sidewalks of not less than eight feet in width.

ATMOSPHERIC PRESSURES.—The least atmospheric pressure at the level of the sea, as given by an authority, is about 28 inches of mercury, or 13.75 pounds per square inch, or 31.7 feet of water. The ratio in which the least atmospheric pressure is less than the above amount at a given elevation, say $Z$, above the level of the sea, is computed with sufficient exactness for practical purposes by the following formula, in which $p_0$ is the pressure at the level of the sea, and $p_1$ the pressure at the elevation of $Z$ feet:

$$\frac{p_1}{p_0} = \frac{52{,}400 - Z}{52{,}400 + Z}$$

This formula, however applies only for heights not exceeding 3,000 feet. In all other cases the height should be divided into a series of stages of 3,000 feet or less; the ratio of the pressures at the top and bottom of each stage should then be calculated and multiplied together, and the result will be the ratio of the pressures at the top and bottom of the entire height. For moderate heights the following rule will be found to give satisfactory results: Deduct from the pressure one-hundredth part of itself for each 262 feet of elevation.

PHILADELPHIA.—Chief Engineer Smedley of Philadelphia is making a topographical survey along the Wissahickon drive, near the new branch of the Pennsylvania Railroad between Chestnut Hill and Germantown. The main object of the survey is to revise the lines of the streets, beginning at School lane and extending northward.

U. S. QUARRIES.—The Compendium of the Tenth Census, recently issued, contains some figures which will serve to give an idea of the magnitude of the quarrying business of the country, which in 1880 gave employment to 39,723 men, 8,059 horses, and 851 mules; had 339 machines for quarrying, 2,290 machines for hoisting, 1,308 machines for dressing, and used $192,175 worth of explosives. The capital invested is given at $25,414,497, and the value of the product in the census year at $18,356,055, there being 1,525 quarries in all. Marble and limestone lead the list with 65,523,965 cubic feet, followed by the sandstone quarries with 24,776,980 cubic feet; crystalline silicious rocks, with 5,188,998 cubic feet; and slate, with 457,267 squares, or 647,270 cubic feet.

OUR NARROW-GAUGE SYSTEM.—There are now actually in operation in the United States over 130 narrow-gauge roads, operating some 8,500 miles of track, and construction is now going on which will result in a considerable increase above these figures. From this it will be seen that about 8 per cent. of the whole railroad mileage of the United States is of the narrow gauge. The standards for these roads have been gradually simplified until that of three feet has been adopted by the great bulk of them. At the present time in some portions of the country the narrow-gauge fever is still on, but it is mostly in the mountainous country of Pennsylvania and in Colorado and Nebraska. In other States the friends of narrow-gauge roads are few, and daily becoming less.

FLORIDA IMPROVEMENTS.—The multitude of invalids who go to Florida have an eye to business as well as to health, and it is their investment of capital, principally, that is developing the resources of the State. Railroads are extending in all directions. A new line to New Orleans, following the coast, has just been completed. Another from Jacksonville to St. Augustine is in process of construction. Two lines are pushing south toward Tampa Bay. Two more are looking toward the Indian River. Still another scheme, controlled by Gen. Gordon of Georgia, is for a railroad from Jacksonville to the extreme southern end of the peninsula. The Okeechobee Drainage Company is making progress with its undertaking, and is perfectly confident of reclaiming hundreds of thousands of acres adapted to sugar culture. The orange interest is also rapidly increasing. In Orange County are thousands of young groves, from five to 125 acres in extent, just beginning to bear.

THE RAPID DESTRUCTION OF THE FORESTS.—MINNEAPOLIS, April 15.—The work of Minneapolis lumbermen in the woods on the upper Mississippi and tributaries having been completed, the figures are given of the winter's cut of logs:

| | Feet. |
|---|---|
| Rum River | 105,000,000 |
| Hillman and Platte | 45,000,000 |
| Little Elk and Crow Wing | 25,000,000 |
| Pine River | 75,000,000 |
| Willow River | 75,000,000 |
| Split Hard | 10,000,000 |
| Prairie River | 35,000,000 |
| Swan River | 25,000,000 |
| Mississippi, above Pokiguma | 15,000,000 |
| Crow Wing | 20,000,000 |
| Total | 430,000,000 |

This exceeds any previous cut by about 50,000,000 feet. All lumbermen say that the crop of the past winter has been extraordinarily good, and far exceeds the estimates made at the beginning of the logging season.—*Globe-Democrat.*

THE output of coal in the United Kingdom of Great Britain during the year 1882 amounted to 156,499,977 tons, which was an increase of nearly two and a half million of tons over the output of the year preceding, although there were thirty-three fewer mines operated. There were 503,987 persons employed in and about the mines, of whom 4,652 were females. There were, during the year, 876 fatal

accidents in the coal mines, by which the deaths of 1,126 persons were occasioned.

THE SHORTCOMINGS OF THE TELEPHONE.—Herr Bretzel (who has just had a telephone put up, calls for the repairer next day)—Look-a-here, my vrent, tidn't you dole me dot dellervone shbeak Cherman unt convers in Cherman?

Repairer—Yes, sir.

Herr B.—Vell, py chiminetty, I dalk Cherman to dot dellervone yesdertay, mid bolideness, unt py unt py it say, "Hello! Phawt the divil are ye jabberin? Come off, ye ould Dutchy." I tond't allow no dellervone to sass me dot vay. Donnerhimmel! Dake id avay!—*From Life.*

CHICAGO SEWERS.—The Sewer Department has advertised a large list of proposals for sewer building.

DYNAMITE.—Dynamite is one of the many products or combinations of nitro-glycerine, and is about thirteen times as powerful as gunpowder. The discovery of this dangerous and potent explosive was made in 1846 by Ascagne Sobrero, then a pupil in the laboratory of Pelouze, the eminent French chemist, who devoted twenty years of his life to the investigation of the chemistry of oils and fats.

Dynamite was patented in the United States May 26, 1868, the patent being granted to Alfred Nobel of Hamburg, Germany, assignor to John Bandmann of San Francisco. It consists of a combination of nitro-glycerine with a substance of great absorbent power, such, for instance, as fullers' earth or rotten stone. By this combination the explosiveness of the nitro-glycerine is controlled as it were, and the compound is capable of withstanding all the ordinary dangers of transportation, while at the same time its explosive power is not lessened. The process of manufacture is very simple. You take a certain proportion of nitric and sulphuric acid and mix them with certain other proportions of glycerine, which is the essence of fat, to make the nitro-glycerine. To make dynamite you only need to mix nitro-glycerine with some absorbent material—fullers' earth is the best—to have dynamite.—*Philadelphia Press.*

THE ERIE RAILWAY IN ENGLAND.—Labouchere, whose financial articles have always considerable weight with English investors, handles the Erie Company, apropos of its recent borrowing and its lease of the Atlantic & Great Western, in this very unceremonious manner:

There are Atlantic and Great Western bonds in existence which bear the following indorsement: "The Erie Company hereby guarantees absolutely to the bearer of this bond, during its currency, the due and punctual payment of the interest thereon." After one coupon was paid on them the liability was repudiated. In 1874 the Erie Company signed a lease of the Atlantic and Great Western Company for ninety-nine years. Six months afterward the man who now, as then, is the President of the Erie Company, repudiated it because it was "too onerous." Even, therefore, assuming that the terms of the lease now proposed were as satisfactory as they are the reverse, it would be folly on the part of any company to surrender itself bound hand and foot to a corporation by which it has been twice deliberately swindled. The Atlantic and Great Western Company may have a valuable railroad or it may not; but, whether a person has a sovereign or a farthing, he makes a mistake when he confides the coin to a highwayman under the impression that the transfer is likely to prove a beneficial one to any one except the highwayman.

It is difficult to arrive at an estimate of the amount which the Erie Railroad has cost the British investing public. Periodically it declares itself to be in a state of insolvency, and the price of its securities falls to almost nothing. They are then bought by astute speculators. The existing board is declared to be composed of knaves. The company is reconstructed, and a new board is elected. This new board at once borrows money. Its balance sheets show a profit. This goes on for a few years. Then it is discovered that the profits in the balance sheets have been myths, while, of course, the borrowed money has disappeared. By this time the speculators have got rid, at a huge profit, to confiding fools, of the securities which they bought, and the members of the board have filled their pockets. There is a fresh reconstruction, and the same game is played once more.

The moment is approaching for the company again to declare itself insolvent, and for its directors to withdraw in favor of a fresh gang of marauders. In 1872 the present board came into existence. The total amount unaccounted for during its administration is $40,238,518. This sum, on the evidence of the company itself has been lost, squandered or stolen. For years the company has never paid one farthing on its indebtedness, except by borrowing. For years the directors have filled their pockets at the cost of the shareholders. So long as, on one pretext or another, money can be borrowed, this will go on. It cannot be borrowed much longer, and therefore one of the periodical smashes is not far distant.

DRAUGHTSWOMEN.—It will interest engineers generally to know that the system of employing draughtswomen in the drawing-office, which has been successfully introduced in several large establishments on the Clyde, and in one or two other places, has now been adopted in the extensive engineering works of Messrs. Clarke, Chapman & Gurney, at Gateshead; Messrs. Swan & Hunter, shipbuilders, on the Tyne, are also making arrangements for the employment of female clerks. Is our engineering profession effeminating?—*Mechanical Engineering.*

THE DATE OF THE BIRTH OF JESUS has always been a puzzle to historians, who cannot agree whether it was in 747, 749 or 754 of Rome. Prof. Sattler, of Munich, now comes forward with an argument in favor of 749, which, if not conclusive, is at least believed to be worthy of studious consideration, as helping to reconcile the testimony of the evangelists with the other historical data upon this point. Four copper coins have recently been discoverd which were struck in the reign of Herod Antipas, one of the oldest sons of Herod the Great, and Prof. Sattler believes they fix definitely upon the real date of the 15th year of the reign of Tiberius Cæsar, when according to Luke, John began to baptize. Though Augustus died in August, 767, Tiberius was appointed a regent a year and a half earlier, he says, or in February, 766, so that it was 780 when Jesus was baptized. This would bring his birth about 749, and corroborative testimony is found in the statement of Matthew that Jesus was an infant when Herod died, which was in 750. The testimony of Luke that Jesus was born in the year when, by a decree of Augustus, Cyrenius, governor of Syria, made the first census of Judea, is not so easy of explanation. The will of Augustus shows that a thorough census of the empire had been made. In fact he made three—726, 746 and 766. The one made, as Luke says, in the reign of Herod, must have been that ordered in 746, which was probably not begun till the next year; and Prof. Sattler thinks the apparent inconsistency of the Evangelist is explained by the supposition that the census was not taken in Jerusalem till two years later, or in 749. Another reason for the belief that this was the year of birth is found in the statement of an evangelist that Jesus began to preach 46 years after Herod built the temple at Jerusalem. It is known that this building was begun 18 years after Herod was appointed regent, or in 734, and this would give 780 as the year of the beginning of Jesus' preaching, and in accord with the other writers. If this ingenious reasoning is to be accepted, then this is not the year 1883 at all, but A. D. 1888. It is not likely, however, that the world will ever jump ahead five years in its reckoning, even if newly found evidence should prove the learned German's theory to be correct.—*Springfield Republican.*

STRAW TIMBER.—A substitute for wood is now made from compressed straw, flax, hemp, or any other fibre which will work into a pulp. The pulp is rolled into thin sheets, which are cemented together by a waterproof glue, then pressed into a solid. The boards can be sawn, planed and polished like ordinary wood, and are now made into counter and table tops, doors and ornamental frames. They sell at one-half the price of the finer pines and walnuts. The artificial timber is practically fireproof and waterproof, having been manufactured under 500 degrees of heat, and boiled without any apparent change of structure. Its tensile strength is greater than that of the oak or walnut, and it weighs more than walnut when dry. A ton of straw produces about 1,000 square feet of boarding.

## THE PANAMA CANAL.

We have the authority of the officials of the Interoceanic Canal Company for denying the rumors started by the Boston *Herald*, to the effect that the plans had been lately changed; substituting about ten locks for the original sea-level project. There is no foundation for such statement; the French engineers are determined to carry out the scheme as first announced—a canal at sea-level, omitting even the tidal-lock, if at all possible.

## THE IRON AND METAL MARKET.

PHILADELPHIA, APRIL 26.

The Iron market has been surprised by the action of the Thomas Iron Co. in reducing its Foundry irons to $22 and $20. Up to present writing very little iron has sold at the reduction and makers are putting forth no efforts in that direction, preferring to let buyers take advantage of the reduction if they see fit. Only the ordinary business is being done, and transactions have been heard of within a day or two at $21.75 for No. 1 Foundry and $19.75 for No. 2. The avowed policy of the leading companies in reducing rates is to drive out competition and reduce production. A number of furnace companies have already signified their intention of discontinuing production, and within three weeks the number of idle blast furnaces will be increased to between 25 and 30. The entire market is sluggish, and the heavy reductions have no effect upon consumers except to induce them to greater caution. Muck Bars have sold at $35. Best quality $36. Refined iron is moving in small lots at 2.10@2.25c. Common iron is active for car building at 1.80c. Nails moving freely at $3.10 @$3.20. Small orders for Steel Rails closed at $39@$40. Old Rails are without any activity, and American are selling at $26.50.

PITTSBURGH, APRIL 25.

The Western Pennsylvania iron market is in an unsettled condition, on account of the recent failure here and the recent reduction of $2 per ton in the selling price of Foundry iron. A combination has been formed to induce the holders of the 50,000 tons of iron to sell at market rates. Production of Crude iron is above requirements, and the larger interests desire to restrict the output by depressing prices to the lowest possible limit. Forge iron is in dull demand and prices weak. The ultimatum of the manufacturers has been submitted and it is this, that unless the workmen accept a reduction to $4.50 per ton when iron is $2, that mills will be suspended. This policy will be carried out throughout the West, and a restriction is probable, whether the workmen agree to the proposed reduction or not. The nail factories are working full, and requirements are sufficient to absorb the supply at $3 in carload lots to $3.20 in small lots. Orders for Bridge iron have been placed, and all the Western bridge works are full of orders for three months. Steel Rails are $39@$40. Merchant steel is in moderate demand and prices are low. The glass trade is sluggish. The coal miners are on a strike to the number of 7,000, against a reduction of from $3½ to $3 per bushel.

CINCINNATI, APRIL 25.

The dullness in Charcoal iron is leading to the closing out of a few additional furnaces, Since January 1, 30 have gone out of blast, and others will likely follow. Requirements for Foundry iron are coming in slowly, and the capacity is now beyond requirements. Mill owners are unable to secure large orders for summer delivery because of the expectation of lower prices. Inquiry for railway material for Southern roads is active and fair orders have been placed. The Hanging Rock region is working its average capacity at present, but unless an improvement takes place soon a few furnaces will go out of blast.

CHICAGO, APRIL 25.

The northwestern iron markets show some slight improvement in Hardware, Sheet iron and Refined iron. In Pig iron there is no improvement. Rail mills have received large and small orders for summer and fall delivery. Plate iron, Tank and Galvanized Sheet are under fair request at last week's figures. Inquiries from jobbers and consumers are for current requirements, and a downward tendency is looked for. The eastern reductions have no effect here. Supplies of Foreign irons are light, and negotiations are in hand for shipments, which are expected about the middle of May.

THE PRICE OF LABOR.

The prices paid for labor in the various cities of this country are as follows:

Bricklayers—New York, $4; Cincinnati, $4.50; Chicago, $3.50; Philadelphia, $3.50; St. Louis, $4.50; Boston; $3.25; Baltimore, $3.50.

Brick Masons (fronts)—New York, $5; Cincinnati, $4.50; Chicago, $4; Boston, $3.50; Baltimore, $4; Philadelphia, $4; St. Louis, $4.25.

Carpenters—New York, $3.50; Cincinnati, $3; Chicago, $3; St Louis, $4.25; Philadelphia, $2.75; Boston, $3; Baltimore, $2.50.

Cabinetmakers—New York, $3.50; Cincinnati, $2.50; Chicago, $3.50; St. Louis, $3; Philadelphia, $2.25; Boston, $3; Baltimore, $2.50.

Finishers—New York, $3.50; Cincinnati, $3; Chicago, $3.50; St. Louis, $3.50; Philadelphia, $1.90; Boston, $3; Baltimore, $2.50.

Foundrymen—New York, $3.50; Cincinnati, $2.50; Chicago, $3; St. Louis, $3; Philadelphia, $2.50; Boston, $3; Baltimore, $2.50.

Blacksmiths—New York, $3.50; Cincinnati, $2,50; Chicago, $2.75; St. Louis, $1.60; Philadelphia, $2.50; Baltimore, $2.50; Boston, $-.

Laborers—New York, $2; Cincinnati, $1.50; Chicago, $1.75; St. Louis, $2; Philadelphia, $2.25; Boston, $2.50; Baltimore, $2.50.

Painters—New York, $3; Cincinnati, $2.50; Chicago, $3; St. Louis, $2.75; Philadelphia, $2.50; Baltimore, $2.25; Boston, $2.50.

Plasterers—New York, $4; Cincinnati, $3.50; Chicago, $3; St. Louis, $4; Philadelphia, $3; Baltimore, $3.50; Boston, $3.50.

Stone Masons—New York, $4; Cincinnati, $3.50; Chicago, $3.75; St. Louis, $3; Philadelphia, $3.50; Baltimore, $3.50: Boston, $3.

Stonecutters—New York, $4; Cincinnati, $3.50; Chicago, $3.75; St. Louis, $3.50; Philadelphia, $3.25; Boston, $3.50; Baltimore, $3.25.

Tin Roofers—New York, $3; Cincinnati, $3; Chicago, $2.75; St. Louis, $2.50; Philadelphia, $2.50: Boston, $2.75; Baltimore, $3.

Slaters—New York, $3; Cincinnati, $3.50; Chicago, $2.75; St. Louis, $3.50; Philadelphia, $3; Boston, $2.75; Baltimore, $3.